The Engineering and Mining Journal

VOL. LXXXVII. NEW YORK, FEBRUARY 27, 1909. NO. 9.

Milling at Grass Valley and Nevada City

Amalgamation, Concentration and Cyanide Treatment Are Employed, Concentrates Being Shipped to Smelters or Treated by Special Process

BY G. E. WOLCOTT*

With the exception of the North Star and the Central mills of the North Star Company and the Pioneer mill near Nevada City for treating concentrates, all of the mills of the Grass Valley, Cal., district employ practically the same process, differing only in regard to details. In this article only one mill, the Empire, will be described; it uses the more common method, and may be taken as a typical installation.

The ore from the mine dumps directly at the Empire plant into bins from which it is fed to a large gyratory crusher situated immediately below. From the gyratory crusher which crushes to a maximum of about 2 in. the ore passes by gravity to bins below from which it is drawn into cars and trammed to the mill building. Here it is fed by automatic feeders to 1000-lb. stamps, making 102 drops per minute and crushing through a No. 7 slotted screen. The stamps give a crushing capacity of about 2¾ tons per 24 hours. The discharge from the batteries passes over amalgamation plates 4 ft. 4 in. wide by 17 ft. long, set at an inclination of 1½ in 12. There is one plate for each battery of five stamps. Both inside and outside amalgamation is used, the inside plates being cleaned twice each month and the outside plates twice every 24 hours. Mercury is added at intervals in the battery. The plates are plain copper without any silver plating.

The pulp from each plate goes to amalgam boxes and then passes to two Frue vanners. The concentrates are not treated at the mill, but are either shipped to smelters or sold to the Pioneer plant at Nevada City.

Concentration

The tailings from the vanners pass through a wooden settling box, where the coarse material is taken out, and passes to the last set of blanket concentrators. The overflow from the settling box passes to 26 canvas-covered tables arranged, as shown in the accompanying illustration. These tables are 12 ft. wide and 8 ft. long on the incline, and are made of a wooden support covered with a coarse canvas cloth. These tables are washed every half hour by means of a length of hose placed at convenient intervals. A board about 6 in. wide is hinged to the lower end of the table and serves to deflect the stream of concentrates into a separate launder. The board is simply lowered by means of a rod extending to the upper part of the table where it can be reached by the operator. The tables have an inclination of about 1 in 8.

From the tables the concentrates pass to a stirring box which serves to keep the pulp in suspension and also to equalize the flow to the Gates vanner, the next machine in the order of treatment.

The tailings from the first vanner pass to a second of the same size (6x10 ft.) for concentration. Tailings from this vanner pass to two canvas-covered tables, 15 ft. square, which are washed every hour. Tailings from these unite with the tailings from the first 26 tables and with the spigot discharge from the settling box, and flow over the final concentrator, a 22x60-ft. canvas-covered table.

The concentration by blankets and vanners is carried out more fully at the Empire mill than is customary elsewhere. Exact figures as to the recovery are not obtainable. The ore varies greatly in value as well as in the percentage of free gold contained. As a rule most of the concentrating mills are able to get their tailings from a $10 mill run down to 50c. or less per ton. With high-grade rock the tailings run higher and may even reach several dollars in value.

Central and North Star Mills

The North Star Company has two mills in operation, one at the North Star shaft and the other at the Central shaft. Each has 40 stamps and both employ practically the same process.

The ore from the mine, after crushing, passes to the stamp battery where it is crushed through a needle-punched steel screen having 19 holes to the inch. The holes in the screen are not continuous, but are interrupted every inch for about ⅛ in., so that the screen is divided into squares by strips of unpunched metal about ⅛ in. across. By this means the screening surface is slightly reduced, but the life of the screen is increased from two to three times. This is due to the fact that the unpunched metal prevents the tearing of the screen.

From the batteries the pulp passes over silver-plated amalgamation plates, 4x18 ft., having an inclination of about 2½ in

IDAHO-MARYLAND MINE, GRASS VALLEY, CAL.

NORTH STAR MILL, GRASS VALLEY, CAL.

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12. After passing over amalgam traps the pulp flows to eight Dodd buddles, making concentrates, middlings and tailings. The middlings are returned to a separate buddle on the same floor. The tailings from all of the concentrators pass to a roughing cone, 7 ft. in diameter with 60-deg. sides, from which the spigot discharge goes to the sand-collecting tanks. The overflow passes to two 5-ft. Merrill classifiers, the spigot discharge from which unites with that from the first cone and passes to the sand-collecting tanks.

Cyaniding

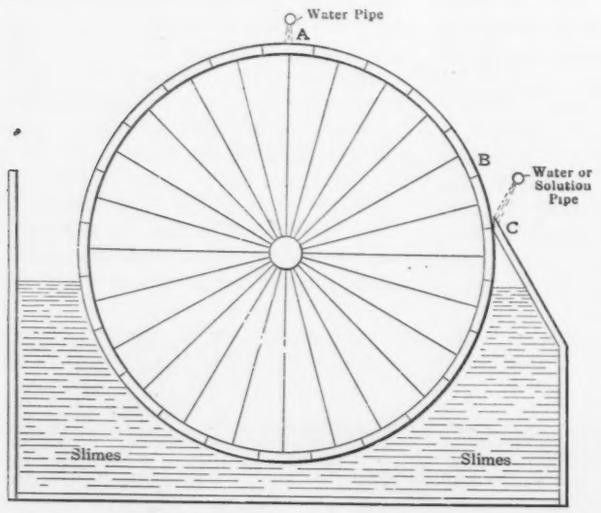
The sands are leached with a 0.10-per cent. cyanide solution, the total treatment taking seven to eight days. The tanks are discharged through four bottom-discharge gates by means of a revolving distributor which is here used to carry water for washing out the tank instead of for pulp. The water is carried to the distributor under pressure, and no labor is used in discharging the tanks.

The slime overflow from the last cones passes to six settling tanks 14 ft. diameter by 12 ft. deep, from which the overflow is pumped to a storage tank above the mill and returned to the mill circulation. Slimes are drawn off from the settling tanks every hour to a slime-collecting tank from which they pass to an Oliver filter.

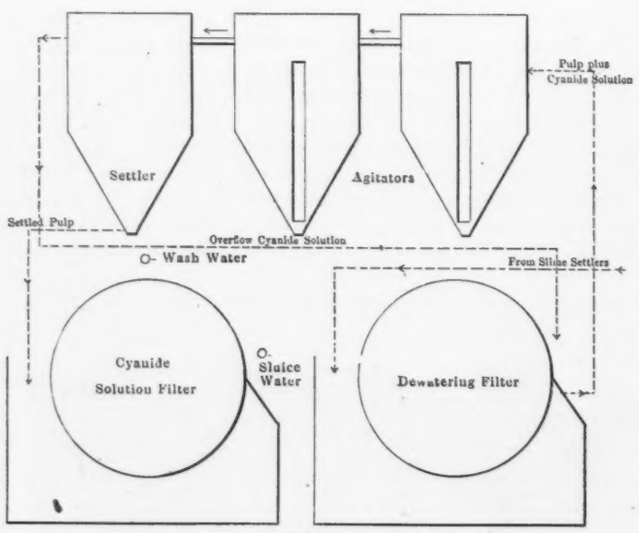
The slime-settling tanks have conical bottoms, and in discharging, the upper portion which contains a lower percentage of pulp, is left in the tank. In this way the water content of the slimes is kept lower than would be possible by discharging the whole tank. The pulp in leaving the settlers has a consistency of about two water to one slime.

The first of two Oliver filters acts as a dewaterer and the slime is washed from the filter scraper with cyanide solution. Cyanide is not used in the battery solution. From the filter the slimes now pass to the first agitation tank. This is connected toward the top with a second agitation tank and this with a third, which acts as a settler. The tanks are 8 ft. in diameter by 7 ft. deep to the conical bottoms which have a pitch of 60 deg. The tanks are of the Pachuca type, the slimes being agitated by compressed air passing upward through a central cylinder. The air is under 7 to 8 lb. pressure. The pulp passes continuously through the two agitation tanks and into the settling tank. In the settler the solution from the top goes to the first Oliver filter to wash down the slimes as already described. The settled pulp passes to the second Oliver filter which extracts the cyanide solution, washes the slimes and discharges it into the tailings flume.

The total time of treatment of the slimes is about 6 hours. The slime heads assay from $1.50 to $2, and the tailings from 20 to 25c. per ton.



SKETCH OF OLIVER FILTER



ARRANGEMENT OF FILTERS

The Oliver Filter

The Oliver filter is an invention of the superintendent of the North Star mills, and is manufactured by the Taylor Foundry and Engineering Company, at Grass Valley. It consists of a revolving cylinder, the periphery of which is the filtering surface. This is divided into 24 compartments, each of which is connected by suction and pressure pipes passing through the center of the machine. The cylinder revolves in a tank which contains the slimes and makes one revolution in from five to six minutes. The portion of the filter in the slimes is subjected to a suction corresponding to about 20 lb. air pressure, which draws and holds the slimes upon the filtering surface. In revolving to the upper part of the cylinder, the pulp is reduced to about 25 per cent. moisture. At this point, *A* in the accompanying illustration, wash water is added from an overhead pipe, and at the same time the suction changes so as to draw the solution through a different pipe. Just before reaching the scraper at *C* the valve arrangement is such that pressure is applied in the filter compartments immediately above the scraper and this, together with the action of the scraper, discharges the pulp into the proper receptacle. The change from suction to pressure takes place automatically in one compartment just before reaching the scraper and suction is again automatically restored upon leaving it. The filters in use are 7 ft. long and 10 ft. in diameter, and have a capacity of nearly three tons per hour. The weight of pulp on one side of the filter very nearly balances that on the other side, so that very little power is required for the revolution of the cylinder. These filters have been in use several months at the North Star and Central mills with satisfactory results.

Treatment of Concentrates

The concentrates from both mills are treated at the Central plant. Pulp is dumped into a circular wooden tank, about 8 ft. in diameter by 8 ft. deep, from which it is discharged by means of scrapers attached to two arms extending from the center to the circumference and revolved by means of a central shaft to which they are attached. The pulp discharges through the center into a pipe line leading to an Abbe tube mill 4½ ft. in diameter by 20 ft. long. Cyanide solution is added just after leaving the tank; this washes the concentrates into the mill. The ratio of solution to solid matter is a little less than 1 to 1. The cyanide solution has a strength of 0.15 per cent. cyanide. The tube mill is run at 20 r.p.m., consuming 16 h.p. An increase of 8 r.p.m. is said to have increased the power consumption to 48 h.p. Pebbles gathered in

the creek bed near the mine are used in the tube mill; this material costs $4 per ton at the mill. The consumption of pebbles is 40 lb. per ton of ore crushed.

The pulp from the tube mill passes over amalgamation plates and then to cone classifiers from which the spigot discharge is returned to the mill. The overflow goes to agitation tanks where it is agitated in solution for six hours. It is then decanted twice and the remaining pulp sent to a small Oliver filter. The concentrates treated run from $30 to $40 per ton, and an extraction during two years' run of 93 per cent. by bullion returns has been made. The consumption of cyanide to 2½ lb. per ton treated and the total cost of treatment is $3 approximately.

PIONEER MILL

The Pioneer mill is a small plant near Nevada City which treats concentrates from the neighboring mills. The process consists simply in roasting "sweet" and leaching with cyanide solution. A minimum charge of $10.50 per ton at the mine is made, and returns are given of 93 to 94 per cent. of the assay value.

The gold from the cyanide solution is precipitated on zinc shavings dipped in lead acetate. The precipitated material is first treated with sulphuric acid to remove the zinc, and then with a mixture of sulphuric acid and sodium nitrate for removing any copper present. The gold is then dissolved in a mixture of 10 lb. salt, 100 lb. commercial sulphuric acid and 10 lb. potassium permangamate. This amount is sufficient to dissolve from $5000 to $6000 in gold. The gold is precipitated from solution with ferrous sulphate and melted with a flux of borax and niter. The resulting bullion is usually 995+ fine.

CANVAS CONCENTRATORS, EMPIRE MILL

Reminiscences of Goldfield, Nevada

BY MARK R. LAMB*

The scenes which occurred in Nevada camps in the early days of the great excitement were probably not equaled anywhere in the world. One thinks of the United States as a highly civilized and law-abiding nation, but what a surprise to see in the Goldfield district acts, which in Russia, are justification for wholesale deportations, and in Mexico, for the introduction of troops with ball cartridges.

Think of a camp with 37 buyers of small lots of ore—37 competing buyers of stolen ore—37 honored citizens who would buy one pound or a ton of ore from miner or mine foreman, or would purchase bullion or zinc precipitate in any shape and quantity, knowing beyond a shadow of doubt that it was stolen from one of the three plants then in operation in the camp. The climax came when the owners of one mill advertised openly to buy bullion—and are known to have bought bullion from their own employees which was stolen from their own mill!

I remember walking in front of Cook's bank in Goldfield with a friend, who was hailed by a miner seated on the curb.

"George, come help me up!"

"What's the matter—drunk?" my companion asked as he went toward the man to help him.

"Oh, no, but I've got too big a load—not whisky, but ore."

He was helped up, staggering, and then he showed us his load of ore bulging from pockets, "leg pockets" (long, narrow bags to hang down the trouser legs), and "ore harness" (double canvas shirts entirely made up of stitched pockets for ore), with finally a big double-crowned Stetson hat, capable of holding at least five pounds of ore.

"Willis, the assayer, tells me that I bring the record loads out of the Mohawk," he boasted. "The foreman had to help me out of the bucket as I came off night shift," he continued, grinning, "and he is one of those cranks who would like to kick about our taking our share."

A story, a true story, is told of two miners who, after getting a little of other people's money together in this way, took a lease and were lucky and struck "jewely" ore. As they were "wise" they attempted to prevent high-grading. One day they caught the entire shift cleaning out a rich streak of ore.

"Here, you fellows, you can't take any of that out of this mine," one said as both covered the miners with six-shooters.

"You have no kick," retorted one of the shift. "You did the same thing on the Riley lease."

"Maybe I did," was the reply, "but I did not take all the best ore, and anyway this is my lease and high-grading don't go—see?" And it stopped.

At one mill the precipitated gold, worth about $30,000, was in the clean-up acid tank. The cutting of the short zinc was not quite finished at the end of the day, so the clean-up room was locked and a watchman placed, with the intention of completing the job the next day. In the morning the windows were found covered on the inside, a tray of "shorts" gone, and as the acid tank had been disturbed it was supposed that the settled gold in it was also gone. Great consternation reigned, but a hurried investigation showed that though an attempt had been made to scoop out the gold, the acid solution was so dense and saturated that the gold had not settled. As the clean-up turned out more gold than was expected, the loss could not have been great. Of course, the stolen gold was melted up in one of the "assay offices."

How great was the temptation at Goldfield is shown by the difficulty that the express company experienced in getting honest drivers to gather up the shipments of stolen ore from the assay offices each night. There was no real need of doing this work at night, but it "looked better."

The sudden "ups" and "downs" of life in Goldfield were simply incredible. The best places to get stories were around the gaming tables and at the club. This latter was merely a social club with no civic duties or responsibilities—a fact empha-

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sized whenever a "vigilance committee" spirit was expected of it, though it had a large and "better element" membership. Over glasses or a little supper one would hear tales of sudden wealth which made the wonders of Aladdin's lamp fade. One fortunate fellow, known to his associates as "Dick" and now rated with seven figures after his name, told of leaving Tonopah as a laborer with a party of surveyors headed for the new camp, then called Grandpa. His pay was $50 per month and board. It was a chance to get to a new strike at no cost. None of his party thought the camp had any merit after they had been over it thoroughly, but Dick, as he naively tells it, wanted a job after returning to Tonopah, so he boosted for Grandpa in order that the survey party be sent out again and he be enabled to get his $50 and board. He located a number of claims in order to have something to sell, then bought a small share in one of the mines which afterward became a big producer. One little deal after another finally made a broker of him and the rest was easy. Ability to succeed was his and the opportunity presented itself.

Another man, now a millionaire, arrived at Goldfield literally broke. He slept out of doors for lack of the price of a bed, and sought the warm wall of a mud bake-oven in order not to freeze. His name is now spoken most respectfully by everyone from Pullman porter to smelter manager. In order to get to Goldfield another pawned a diamond ring—his last available asset. He is now an honored member of the Rocky Mountain Club of New York, and pawns no more.

Two men, both big fellows, came to me one morning when there was nc chance for them except to shovel tailings from the tanks. It was new work for them, so they worked hard—and beat the record. This led to a contract and that month the tailings gave no trouble. But a month was all they wanted. A lease on the Mohawk soon fixed them beyond all care—unless they put the profits back into some other hole.

Labor was hard to get and harder to keep. I have decided that of all labor, batterymen are the most dependable. Whether it is because he works so hard for his pay or because it takes a steady, phlegmatic man to run a battery, I know not, but he seldom quits to gamble, or in fact, for anything but a good excuse. And although he has the best chance in the world, a millman rarely high-grades.

My first task in Goldfield was to thaw out a frozen pipe line ten miles long. The temperature was about zero. The line had been loosely and hastily laid and in some places was above ground. Money could hardly hire men for outside work. Grave diggers were paid $20 per day, for no one was prepared with clothes for such weather, as the year before had been mild and the second year before—no one knew, as the place was uninhabited. But finally by building fires with sage brush, digging frozen ground, drilling into the pipe, and moving along bit by bit as the water showed at the drill holes we got the water flowing through the pipes again.

The railroad to Goldfield made money It paid for itself in six months. Strange things happened during the first few months after the completion of the branch. For instance, the company that I was working for was anxious to get in a small boiler for a mill then being built. The freight agent would not receive it, saying that the road was already blockaded with freight, but in his capacity as express agent he gladly loaded the boiler into a freight car, charged us express rates and sent it through. One leaser, immediately after securing a good block of ground, hurried to Denver, bought his hoisting machinery, chartered a special train and returned to Goldfield with the machinery in less than passenger time. It was expensive, but his lease allowed him only six months and every moment counted. He sunk 300 ft., found rich ore and cleared just $50,000 over all expenses in that time.

Speaking of leasing brings a flood of interesting reminiscence. While I was at the Combination mill our assayer and samplers regularly tested the ground as fast as it was opened up by the various leasers, so that we actually knew before the leasers themselves, when good ore was struck. One leaser on the extreme end of the Combination ground had sunk his shaft within a few feet of the endline of the claim. One day the assayer reported that the ore assayed $600. We were all excited, went down to see the ore, studied the formation and decided that the ore must certainly run into the adjoining claim. The stock of the latter was then selling at 20c. a share. In spite of all favorable indications, only two of the staff had the nerve to buy—and the stock went to 85c. in two days. It can easily be imagined how we felt because we had not bought. An "investment" of $500 on margins would have made a royal profit of $25,000. I hate to spoil this, but must add that the men who did buy, kept on buying until the stock dropped again, since the ore did not go where we expected it. One of these men is still in Goldfield, has made and lost many fortunes (on paper), but still has his salary to live upon.

One newsboy in Goldfield got the speculative fever, but he was cold blooded and took no chances. Jimmie was a favorite with the brokers, and kept his mouth shut, so when one of them knew of a planned manipulation (it required an expenditure of only $1000 or so of real money to cause a flurry). Jimmie was tipped off and so cleared a little profit. His bank account soon reached $10,000.

The margin between success and failure is sometimes very narrow. One leaser—an Italian—missed the ore on his block of ground, spent his grub-stake of $5000, and in disgust sold his lease for $3000. His successor, a clever young fellow with several years of experience in prospecting and mining, found ore. It was of such grade that he took his bed and tent to the ground, using them to cover and catch the rock blown out by the first few shots. He took out over a hundred thousand in the first two weeks.

On another lease a party of Easteners had begun sinking in a spot which brought them ridicule from all sides. After spending all their capital they had agreed that they were wrong; one of the party gave up in disgust and started for Chicago to begin life over. Just out of Denver he received a telegram from his partners, "Better come back. Ground looking better." His remarks will not bear repeating. This same hope had been held out ever since the shaft had been started. Within a few hours another telegram was handed him that read, "Hurry back. Have cut a small stringer of rich ore."

"Porter," he said, "if you bother me with another telegram before morning there will be a nigger missing on this car." But at 12 p.m., the conductor brought him a telegram to the smoker. It said: "Have cut seven feet of $900 rock." That was more than he could stand so he started back. This was the first of the rich leases on the Mohawk mine, which has produced literally tons and tons of gold, for one carload, alone, of special picked ore contained more than a ton of pure gold.

A friend took me to see a mine of his which was very promising. He had recently bought it and was building a mill on the ground. I presume thousands of men had been over the claim after its discovery, examining the vein, commenting on the coarseness of the gold and envying the lucky owner. I followed suit. He gave me specimens which were more than half gold. After I had returned to Goldfield and had almost forgotten that mine, a wise prospector came along and took a lease on the surface dirt. Just the loose stuff, mind you, with no rights to do anything but dry-wash the loose gold. For weeks he took out $1500 a day clear profit. Now, why did not *I* think of that?

All short trips to examine mines were made in autos. As there were few roads the autos had to run over sage brush, boulders and cactus, but serious accidents were rare. The expense of such trips was not taken into consideration. If a new discovery was made it was simply a question of getting there first at any cost. One claim near the original discovery would sell for the price of several autos, whether it had good indications or not. Such claims are always "extensions" of the original discovery. Autos have made the trip from Tonopah to Rhyolite and back in a day, a recorded distance of more than 250 miles.

Electric Hoists as Adapted for Coal Mines

The Numerous Advantages of Electrical Winding Are Discussed, and the Most Improved Equalizing Systems Are Compared in Detail

BY R. H. ROWLAND*

In most of our modern collieries and mines, electric haulage is adopted, if not in its entirety, at least to some extent, and its advantages over mule and steam haulage, from results of experience have been tested and proved at various mines throughout the United States and foreign countries. Briefly, the advantages consist of an increased production at a decreased cost, a very material factor to the operator.

The majority of colliery and mine operators, at whose mines are installed steam hoisting plants, are not desirous of replacing their installations by electrical machinery, although these steam plants might be inefficient and uneconomical. Perhaps the chief reason for their objection to the installation of electricity is owing to the initial cost of installing, and the consequent disposal of the original equipment. However, at many mines operated in countries where fuel is expensive, large companies have already begun to tear out steam hoisting plants and substitute elcctrical installations.

Winding engines may be driven by three-phase induction motors, or by direct-current motors, either direct-coupled or through gearing. For large winders, the adoption of direct-coupled motors is preferable, and they become a necessity for 400 h.p. and above. The inertia of direct-coupled motors is considerably less than that of geared motors, and small inertia is of importance when high acceleration and high rope speeds are required. Three-phase induction motors may be used in connection with three-phase power transmission. Slow-speed induction motors of about 60 r.p.m. should be built with 25 cycles, but not for 60 cycles, owing to the poor performance, and the high price.

Selecting the Style of Motor

Three-phase motors may be used whenever the losses in the starting resistance are a small percentage of the total power consumption, and when the weight of the drum or friction wheel is low. In this case the unbalanced load produces a sufficient retardation, without regenerative braking. If the power can be advantageously generated in a direct-current unit in the vicinity of the winding engine, direct-current motors can be successfully adapted. Also, whenever the conditions given above for induction motors are not fulfilled.

Advantages of Electrical Winding

Electrical winding has different advantages compared with steam winding engines. Some of these advantages are in the greater flexibility and uniform torque of the electrical motors, which reduces the flywheel effect of the winding engine to the minimum amount, while the steam engine must in many cases have a greater flywheel effect due to its reciprocating action. These features of electrical winding result in many detailed advantages, such as smaller boiler engine capacity, the practical elimination of losses by heat radiation of a plant with considerably smaller capacity, no overload or variable strain of the material and apparatus of the power house, and lastly, the possibility of centralization of the production of energy necessary for all the machinery in the mine. Other advantageous features of electric hoisting are the extremely simple and smooth action of the controlling apparatus of the winding engine, and almost constant accelerations, (not obtainable with steam hoists).

Electric hoists, therefore, insure less maximum speed with the same time per wind, or with the same maximum speed less time per wind, this latter fact resulting in an increased carrying capacity of the shaft. or in other words an increased output of the mine.

The Saving in Fuel

Perhaps the most important advantage is the considerable saving in steam or coal per unit of material extracted. This, however, applies only in the event of it being possible to erect the electrical equipment so that the power station is able to produce the energy with practically 100 per cent. load factor, and it is only in this fact that a saving can be obtained. In this way the electrical energy is generated with the maximum possible efficiency.

The power demand of winding engines varies within wide limits; during the decking period no power is consumed by the winding motor, while during the accelerating period the load on the winding motor is increased to two or three times the average load calculated for the total time. The load curve, therefore, will be periodic, and its shape entirely dependent on the mechanical outlay of the winding engine. Such a load curve is shown in Fig. 1 by the letters *X A B C D E X*, which embody an area. The average ordinate of this polygonal line gives the mean power for the winding motor, and in order to obtain a constant load following the line *A D a d*, a means must be found for storing during the pause, the energy represented by the area *E D a F* and delivering same to the winding motor during the period of overload *A B C D*. This result can be obtained by using a heavy flywheel, arranged so as to absorb energy during the interval *D a* and to give back same during the time *a d*, so that it will thus be possible to install a power station working continuously with 100 per cent. load factor and designed for the average power demand. Such a power station would result in a "considerable saving in steam or coal per unit of material extracted," as previously stated.

Equalizing Systems

There are different load equalizing systems, chief among these are the Ilgner motor-generator system, the Ward-Leonard system, and the Westinghouse converter-equalizer system. The Ilgner system is practically an adaptation of the Ward-Leonard motor-generator system. The motor of the motor-generator is either an induction motor with slip rings (Fig. 2) or a direct-current shunt motor (Fig. 3). These diagrams show the Ilgner system mostly used at the present time in order to arrive at the equalizing effect above referred to.

The generator is shunt wound and connected to a direct-current shunt-wound winding motor. The generator and the winding motor are separately excited, and by varying the excitation of the generator, any voltage between minus maximum and plus maximum may be applied to the winding motor terminals. The operation is as follows:

The motor (*A*), Fig. 2, is first started and brought up to speed with the flywheel (*B*), dynamos (*C*), and the exciter (*G*) on the same shaft. The field circuit (*D*) of the exciter is then closed and current is supplied to the field winding (*E*) of the winding motor. By moving the controller (*F*), which consists of a reversible field rheostat, the field current of the generator, and consequently the voltage at its terminals, can be varied to any desired degree.

The motor coupled with the flywheel

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must be allowed to slip in order to let the flywheel discharge a part of its kinetic energy. This is obtained by inserting a resistance in the secondary of the induction motor (Fig. 2), or by regulating the field excitation of the direct-current shunt-wound motor (Fig. 3). The regulation is arranged so as to work automatically and keep the input of the motor constant. The speed variation with an induction motor cannot, for economical reasons, be higher than 10 per cent. of the maximum speed, while with the direct-current shunt motor the speed variation may be as high as 30 per cent.

Westinghouse Converter-Equalizer

The Westinghouse converter-equalizer may be used in conjunction with either alternating or direct-current motors. The equalizer for alternating-current motors, shown in Fig. 4, consists of a rotary converter (*A*) connected through transformers (*B*) to the high-tension transmission lines. The rotary converter on its direct-current side is connected to a direct-current machine (*C*) with flywheel (*D*), and is compounded in a special way, so as to compensate automatically for the magnetizing currents of the induction motors in the system. The voltage of the direct-current flywheel machine is controlled automatically by a quick-acting regulating apparatus (*E*) from the high tension transmission line through series transformers. This enables the converter-equalizer to discharge energy into the high-tension system whenever the load of the latter is greater than the constant station output, and to store up energy in the flywheel whenever the power demand in the high-tension supply system is less than the constant output of the station.

When no load is on the high-tension system, the rotary converter is acting with 100 per cent. power factor, giving up to the flywheel the total constant station output until maximum speed is reached. The capacity of the flywheel is made sufficiently large to take care of the overload periods of the high tension system. The flywheel machine is preferably built for high speeds in order to obtain high electrical efficiency combined with light weight. The flywheel may have a maximum slip of 40 per cent. of its maximum speed, but in ordinary service 30 per cent. will be sufficient.

The over-all efficiency of this converter-equalizer (the energy input divided by the energy output) is about 70 per cent., which can at least be compared to a chemical accumulator, besides having the advantage of a cheaper price for the output, and a smaller cost for maintenance and repair.

In view of the fact that this converter-equalizer is only handling the overload and underload energy, which represents but a small amount of the constant station energy delivered, the efficiency of the whole system will be considerably higher, and for the small loss in the load equalizer, a gain of at least 8 to 10 times the amount results in the power station. This is due to the fact that without the load equalizer a larger station capacity to withstand the maximum load had to be provided, and is operated with a very small load factor. The average load factor of the winding engines in most cases is not higher than 15 to 20 per cent., and the same load factor is on the station without the load equalizer.

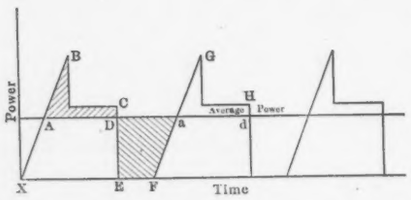


FIG. 1. THE LOAD CURVE IS DEPENDENT ON OUTLAY OF WINDING ENGINE

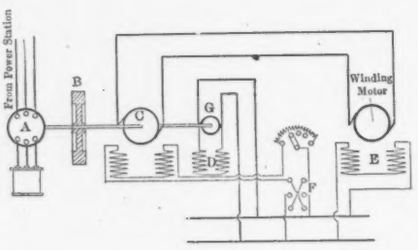


FIG. 2. ALTERNATING CURRENT POWER TRANSMISSION

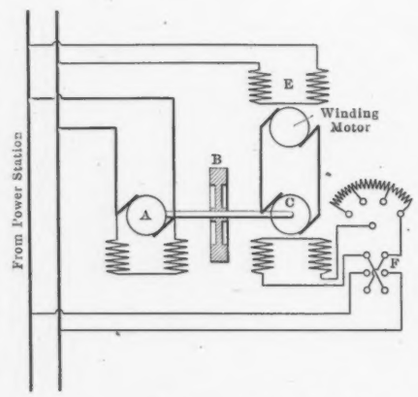


FIG. 3. DIRECT CURRENT POWER TRANSMISSION

This converter-equalizer in connection with alternating-current motors may be installed at any suitable place on the alternating-current system, and need not be situated near the winding motor.

The equalizer for direct-current motors shown in Fig. 5, consists of a rotary converter (*A*) connected to the alternating-current mains in the same way as is shown in Fig. 4. The direct-current side is connected to a direct-current machine (*B*) fixed on the same shaft with a flywheel and a direct-current machine (*C*). This latter machine being connected in series with the machine (*B*) acts as a voltage regulator in order to obtain a variation of voltage on the winding motor terminals (*D*) between minus maximum and plus maximum.

The direct-current voltage of the machines (*A*), (*B*), (*C*) is one-half of the maximum voltage of the winding motor (*D*), so that if the latter is built for 500 volts, the machines (*A*), (*B*), (*C*), will have 250 volts each.

When the winding motor (*D*) has to be started, the voltage of the regulating machine (*C*), will be opposite to that of the machine (*B*). By decreasing gradually the voltage of (*C*) to zero, and increasing it in reverse direction any desired tension between zero and maximum may be applied to the winding motor. In order to regenerate it is only necessary to decrease the voltage impressed on the winding motor.

The energy will always be taken from the alternating-current supply circuit with a 100 per cent. power factor; or a leading current may be sent into the same by properly regulating the shunt field of the rotary converter. The voltage regulating machine (*C*) can sometimes be omitted, and the winding motor (*D*) started by resistance. This is applicable in all cases where the losses in starting resistance are very small.

The Load Variations Are Equalized

This equalizer will also act so as to equalize at the same time the load variations on the alternating-current circuit produced by any other motors. It may be compounded in a suitable way in order to regulate the power factor of the whole alternating-current system. If it is not desired to equalize the entire alternating current load, the automatic regulator will be connected into the direct-current side of the converter and the motor magnet operated by direct current. It is essential that this converter-equalizer for direct-current motors be installed in the neighborhood of the winding engine.

The direct-current winding motor will usually be shunt wound, particularly if electric regeneration is required, but it may be series wound if used in connection with large haulage gears.

Comparison of Systems

It may be interesting to engineers and others concerned to here make a comparison of the advantages and disadvantages of the Ilgner motor-generator system and the Westinghouse converter-equalizer system for the operation of winding engines.

The Ilgner system uses a motor generator which transforms the total current consumed by the winding motor from three-phase energy into direct current,

while the Westinghouse converter-equalizer transforms only that amount of energy into direct current, and back into polyphase currents, which is in excess or below the constant output of the station. The former is an indirect system and the latter a direct system.

Owing to the fact that the Ilgner system has a direct-current motor on the winding engine, which, if geared to the winding drum, might cause trouble, due to sparking on account of the vibrations on the pinion, this trouble is eliminated by the polyphase induction motor with slip rings which is adopted for driving the winding engine in accordance with the Westinghouse system.

In underground work, and especially in coal mines, induction motors are generally adopted; the use of direct current for the winding engine would therefore make it necessary to use two different electrical systems. With the Westinghouse equalizer, it would only be necessary to use polyphase current in the mine.

As stated previously, the Westinghouse converter-equalizer may be installed at any convenient place in connection with the high-tension transmission system, in the power station in the center of the power consumption area, or near the winding engine. So that if the winding engine is located at a place which is not easily accessible, repairs can be made at a place which is convenient, and where the converter equalizer is installed. If, therefore, as often occurs, the mine is situated at a remote place in the mountains, it will be extremely inconvenient to transport spare parts and make repairs in case of any damage to the heavy motor generator used in connection with the Ilgner system, which it is essential must be installed near the winding engine at the shaft.

Should any irregularity happen with the motor generator of the Ilgner system, it is necessary to shut down the winding engine, but with the Westinghouse system, if the station is unable to stand the overloads, the winding engine can still continue its operation, although at a reduced load.

Another advantage of this equalizer is that if the same is handling light loads, as is often the case at night time, so that no equalizing of the station is necessary, it may be shut down; but the motor generator of the Ilgner system cannot be shut down, although its load equalizing effect is not needed under this condition, and therefore a great loss with a low load factor results.

The Motor-generator Must be Shut Down

During long pauses in the operation of the winding engine, it is advisable to shut down the motor-generator of the Ilgner system, owing to the fact that when the flywheel is started again by the induction motor, there is produced such an overload shock on the power station that in order to avoid it, it is preferable to run the motor-generator for a longer time without load; with the Westinghouse equalizer, however, during long pauses, the machine can be shut down, owing to the converter acting with 100 per cent. power factor, the light flywheel when started again does not require more than approximately one-quarter of the apparent power of the Ilgner motor-generator.

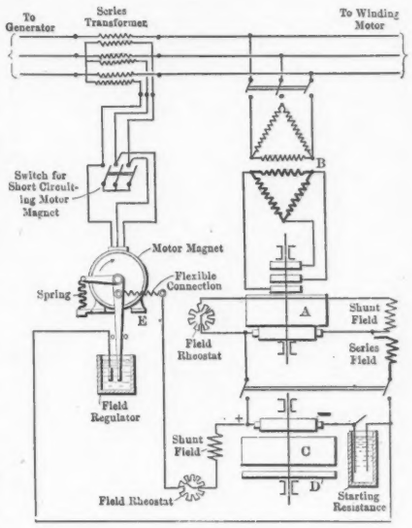


FIG. 4. EQUALIZING SET WITH A. C. MOTORS

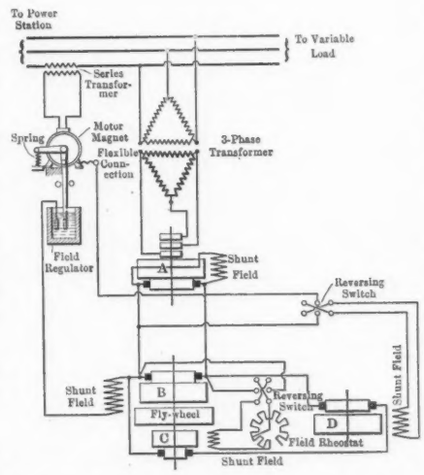


FIG. 5. EQUALIZING SET WITH D. C. MOTORS

The flywheel of the Ilgner motor-generator can only charge and discharge a small amount of its total kinetic energy, which fact makes it very heavy. The heavy flywheel has to be built up in one or more solid steel disks in order to get sufficient strength with the high speeds, and it is a very difficult matter to transport these flywheels on railroads, owing to the limits of the loading gage, and for large high-power winding engines, transportation would in many cases be impossible.

The flywheel of the Westinghouse converter-equalizer can charge and discharge three times as much of its total kinetic energy as the Ilgner flywheel, and this enables it to have one-third the weight. A light flywheel, too, can be made in one piece, and transport by railroad does not entail any difficulties. The flywheel, also, can be made for any size of winding engine.

It is necessary that the capacity of the Ilgner generator be sufficient to handle the peak load, but the capacity of the flywheel machine of the Westinghouse equalizer need only be sufficient to handle the difference between the peak load and the average load; also the speed can be higher and the cost lower, in the former case the speed is less than the latter. The transport of heavy fly-wheels in mountainous districts is difficult, while light flywheels can be moved without trouble.

The Ilgner flywheel must be built of a large diameter in order to obtain a sufficient speed at the radius of gyration, but the Westinghouse flywheels with high speeds are built with small diameters.

Finally, the installation of the Ilgner motor-generator means in many cases the erection of a sub-station and therefore de-centralization, while the great advantage of polyphase high-tension transmission is the absence of sub-stations with rotating machinery which needs inspection. The installation of the Westinghouse equalizer with an induction motor for winding does not necessitate the erection of a sub-station. It should, in fact, be preferably placed in the power station if general conditions permit.

There are various schemes of electrical winding plants to suit the several conditions; however, it would go beyond the scope of this article to embody the whole, and while much has been said in the engineering papers regarding the adoption of flywheels as being unsatisfactory, the Ilgner system of electrical hoisting has found much favor on the continent.

In figuring the mechanical data, the details for the engineer to carefully consider are the shaft, loads, speeds, decking operations, rope, pit-head sheaves, winding gear, and position of winding engine; the electrical data embodies the power house, etc.

The friction wheel so largely adopted on the continent is a factor to be recommended whenever winding engines driven by electrical motors are to be considered, owing to the fact that the small weight of the friction wheel, and the consequent large reduction of the total mass allow the winding motor, as well as the equalizing plant, to be much smaller, and therefore cheaper. The wear and tear on the

rope is less than with the drum winder, and the possibility of overwinding, causing the cage to run up against the pithead sheaves, is avoided, owing to the fact that the rope will slide on the wheels as soon as the cage reaches the bottom of the pit; lastly it is impossible to exceed a given strain on the rope, as same will slide should the pull exceed a certain maximum. Regarding the costs of installation of the respective equipments, this is entirely dependent on the conditions to be fulfilled, but it may be generally taken that they compare favorably.

The Crab Locomotive in Coal Mines

The Jeffrey Company, of Columbus, Ohio, has recently added to its line of electric mine locomotives a new type of gatherer known as the "crab locomotive." With the common type of gathering locomotives provided with a reel, it has been difficult to pull loaded cars out of rooms driven to the dip. Again, where the tracks are level, it is often found economical to push the empty into the room by hand, so that mechanical means are required only for hauling out the loaded cars. The crab locomotive was designed to overcome these faults, and is supplied with a small winding drum, or crab, which is mounted on the power end of the locomotive. On this drum is wound 350 ft. of ⅜-in. flexible wire cable, which latter is used for pulling the loaded cars from the room and out onto the entry track.

In mines where the double-entry system is used, the locomotive usually hauls a trip of empty cars into one entry and drops them off at the rooms where they are required. Returning on the other entry, it stops in front of each room where a loaded car is ready. The trip rider then drags the cable into the room, attaches it to the car and signals the motorman who starts the crab motor and pulls the car out of the entry track. The locomotive then either pulls the car to the next room, or leaves it standing until as many cars have been drawn from the room as are required to make up a trip. These loads are then coupled up and hauled to the parting. On the return trip the empty cars are distributed in the entry from which the loads have just been removed, and the locomotive gathers a load of cars from the entry which was supplied with the empties on the preceding trip.

Where the single-entry system is employed, the locomotive usually runs in with a train of empties. Stopping successively in front of the rooms in which loaded cars are ready, it hauls each car to the entry track and pushes it ahead to the next room, dropping off an empty to replace each loaded car taken out. When all empties have been distributed, the motor then proceeds to the parting with the loads gathered. By each of these methods a locomotive can gather from 75 to 200 cars per day, depending upon local conditions.

The crab device is made as compact as possible; the drum is driven by the gearing, through a friction clutch, which acts not only as a smooth starting device for the cars, but also as a safety device in case a car becomes derailed, or the motorman fails to throw off power until the car bumpers strike those of the locomotive. Without this friction arrangement the cable would in such cases break, or serious injury would result to the gearing or motor itself.

The motor which actuates the crab being entirely separate from the locomotive motor, is controlled by a separate starting box, and when the car approaches the entry track the motorman starts the locomotive ahead. As it advances past the switch point the car follows and runs out upon the entry track without either the locomotive or the winding of the crab being stopped. The crab may be stopped when the car strikes the locomotive, but the locomotive need not stop until the room is reached from which the next load is to be hauled. The cable may be paid out from either end of the locomotive. Ordinarily, however, it is more convenient to take the cable out past the motorman, as that end of the locomotive is then opposite the room mouth, and the motorman can watch the light carried by the trip rider, and can see him signal to start winding. He can also watch the car to better advantage as it takes the switch, and can stop instantly if it should become derailed.

One advantage claimed for the crab locomotive is that, except where there are rooms driven to the rise at so great a pitch that the cars cannot be pushed into them by hand, it may replace animal haulage at once without making any changes in the track or conditions in the rooms. When rooms are driven to the rise, it is impracticable to use the crab device for hauling cars into these chambers.

Testing Explosives

Director George Otis Smith of the United States Geological Survey has sent a letter to manufacturers of explosives announcing a series of preliminary tests of such explosives in the presence of inflammable gas, coal dust and the like. The tests are to be made in the experiment station at Pittsburg, Penn., and the object will be to make official studies of articles which manufacturers may desire to have certified with regard to their permissibility for use in mines containing gas or dust in dangerous quantities. The conditions of the test are as follows:

(1) The manufacturer is to furnish 100 lb. of each explosive which he desires to have tested; he is to be responsible for the care, handling and delivery of this material at the testing station on the United States Arsenal Grounds, Fortieth and Butler streets, Pittsburg, Penn., at the time the explosive is to be tested; and he is to have a representative present during the tests who will be responsible for the handling of the packages containing the explosives until they are opened for testing.

(2) No one is to be present at or to participate in these tests except the necessary Government officers at the testing station, their assistants, and the representative of the manufacturer of the explosive to be tested.

(3) The tests will be made in the order of the receipt of the applications for them, provided the necessary quantity of the explosive is delivered at the plant by the time assigned, of which due notice will be given by the Geological Survey.

(4) Preference will be given to the testing of explosives that are now being manufactured and that are in that sense already on the market. No test will be made of any new explosive which is not now being manufactured and marketed, until all explosives now on the market that may be offered for test have been tested.

(5) A list of the explosives which pass certain requirements satisfactorily will be furnished to the State mine inspectors, and will be made public in such further manner as may be considered desirable.

A South African Colliery Accident

SPECIAL CORRESPONDENCE

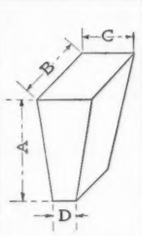
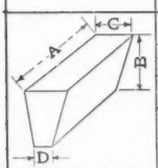
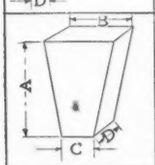
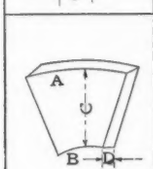
The commission appointed by the Natal government to inquire into the cause of the explosion occurring in the Glencoe colliery early last year through which the lives of 70 persons were lost, has issued its report. The accident was due to an excessive charge of explosive, where the coal had been previously imperfectly blasted, creating a cavity in which gas accumulated. Serious blame is thrown upon the management for laxity of control and for failing to inspect the workings with proper frequency. Generally speaking, the coal mines of South Africa are remarkably free from danger of explosion, but the Glencoe mine is one calling for a special vigilance. One of the recommendations made is that in collieries where safety lamps are required, a new regulation should provide for the removal from a working place of all loose coal before drilling or coal-cutting is resumed.

Shape Brick and Methods of Calculating Requirements for Furnace Work *

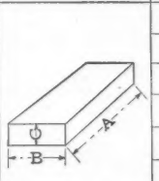
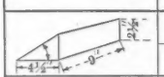
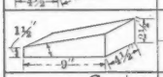
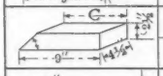
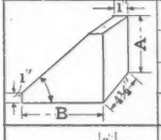
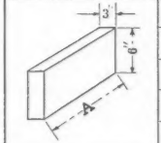
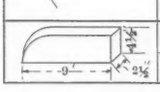
By Ulrich Peters

A subject to which perhaps the least attention is paid in practical or theoretical discussions by engineers is that of the detailed construction and arrangement of bricks in furnaces, flues and foundations. Usually the mill bricklayer is supplied with no other information than an outline drawing of the furnace and flues he is about to build or rebuild. Detail questions generally come up when the roof arch or some other part of the furnace falls in—sometimes almost before the light of its fire is seen. The old-time method of chipping bricks to suitable shapes has been abandoned almost entirely by adopting shape bricks, and in order to obtain practical gas-tight walls of greater strength all necessary cutting to exact dimensions should be done by grinding. This gives beter results in quality of workmanship and economy of labor.

The building of the different parts of the furnace has an important bearing on its life. So-called shape bricks of the best obtainable grade of refractory material of moderate sizes are used and kept in stock. Suitable ready-made shapes have been in practical use for years for building up and repairing walls, ports and arches in the least time and with the least cutting and trimming of the bricks. Most of the geometrical brick shapes have in the interval progressed to certain standard dimensions, commonly called "stock shapes." Sizes vary more or less with the maker and the composition of the refractory material, which may have a different coefficient of expansion and contraction in the process of manufacture. So far only the natural tendency has been followed in the adoption of these standard forms, and no attempt seems to have been made to investigate for the best geometrical forms, or those giving the greatest number of combinations with the smallest number of different stock shapes. Complicated and irregular shapes are avoided as much as possible in furnace construction, as they are liable to cracks and distortions, and not being specially repressed, are not as strong as the sizes now in common use.

Sketch	Dimensions A	B	C	D	Name	Included Angle	No. of Brick to the Circle	Inside Circle
	9″	4½″	2½″	1⅞″	No. 1 Wedge	3° 32′	102	
	9″	4½″	2½″	1½″	No. 2 Wedge	6° 21′	56	
	9″	4½″	2½″	2″	No. 3 Wedge or Bullhead	3° 10′	113	
	9″	6¾″	2½″	1½″	No. 2A Wedge	6° 21′	56	
	9″	6¾″	2½″	2″	No. 3A Wedge	3° 10′	113	
	9″	13½″	2½″	1½″	No. 2 Wedge Tile	6° 21′	56	
	9″	13½″	2½″	2″	No. 3 Wedge Tile	3° 10′	113	
	9″	13½″	3½″	2¼″	13½″ Arch[1]			
	9″	4½″	2½″	2¼″	No. 1 Side Arch	5° 0′	72	
	9″	4½″	2½″	2″	No. 1A Side Arch	6° 21′	56	
	9″	4½″	2½″	1¾″	No. 2 Side Arch	8° 23′	42	
	9″	4½″	2½″	1½″	No. 2A Side Arch	12° 40′	28	
	9″	4½″	2½″	1″	No. 3 Side Arch	18°	20	
	9″	4½″	4″	2½″	No. 1 Key	3° 10′	113	
	9″	4½″	3½″	2½″	No. 2 Key	5° 43′	63	
	9″	4½″	3″	2½″	No. 3 Key	9° 43′	38	
	9″	4⅜″	2¾″	2½″	No. 4 Key	14° 24′	25	
	9″	6″	5⅜″	2½″	9″ x 6″ Key			
	9″	6½″	4½″	2½″	No. 1 Circle	30°	12	33″
	9″	7 9/16″	4½″	2½″	No. 2 Circle	25° 24′	14	45″
	9′	7⅛″	4½″	2½″	No. 3 Circle	20°	18	51″
	9″	6 5/16″	6″	3″	No. 1 Cupola Brick	24°	15	30″
	9″	6¾″	6″	3″	No. 2 Cupola Brick	21° 10′	17	36″
	9″	7 3/16″	6″	3″	No. 3 Cupola Brick	17° 10′	21	43″
	9″	7½″	6″	3″	No. 4 Cupola Brick	14° 24′	25	60″

1. In all Tapers.
2. For Regenerative Furnaces.
3. All Sizes.
4. For Inclined Wells and Skewbacks, etc.
5. Same as Feather Edge.
6. Used for Supporting Checker Work of Regenerative Furnaces.
7. Used around Door Openings.

Sketch	Dimensions A	B	C	Name	Included Angle
	9″	4½″	2½″	9″ Straight	
	9″	4½″	1″	1″ Split	
	9″	4½″	1¼″	1¼″ Split	
	9″	4½″	1½″	1½″ Split	
	9″	4½″	2″	2″ Split	
	9″	2¼″	2½″	Soap	
	9″	2¾″	2¾″	Checker Brick[2]	
				Blocks and Straights[3]	
				Feather Edge[4]	29° 3′
				Edge Skew[5] or	18° 26′
				No. 3 Skew	
			6½″	No. 1 Skew[5]	41°
			7″	Bevel End[5]	51° 20′
				Bevel Edge[5]	48° 20′
	7″	7″		7″ x 7″ Skew Back	45°
	7″	9″		7″ x 9″	36° 25′
	9″	9″		9″ x 9″	45°
	9″	12″		9″ x 12″	36° 1½′
				13″ Regenerator Tile[6]	
				21″	
				22″	
				24″	
				27″	
				Jamb[7]	

DETAILS OF VARIOUS SHAPE BRICK USED IN FURNACE CONSTRUCTION

Standard Shapes

The adopted standard mill size of a straight furnace brick in the United States measures 9 in. long, 4½ in. wide and 2½ in. thick. As a stock shape it is commonly known as "9-in. straight," and is shown in Fig. 1. Evidently a greater number of combinations would result from adopting 2¼ in. in thickness instead of 2½ in. The stretcher as well as the header courses, being then multiples of the individual dimensions, would match in all the various combinations for plain wall constructions. Firebrick, as well as the common red brick, are usually undersize and laid with very little clay mortar; if possible, rubbed close at the joints. Therefore little or no allowance is given for the vertical joints in the following standard thickness table:

Inches.		Ft.	In.
½ brick thick..... 4½	2¾ bricks thick..	2	0¾
1 brick thick..... 9	3 bricks thick..	2	3
1½ bricks thick....13½	3½ bricks thick..	2	7½
2 bricks thick....18	4 bricks thick..	3	0
2½ bricks thick....22½	etc.		

For the horizontal joints of the courses of furnace masonry about ¼ in. for mortar is allowed, so that the hights of brick walls are as follows:

Inches.	Inches.
1 course high..... 2½	5 courses high.....13¾
2 courses high..... 5½	6 courses high.....16
3 courses high..... 8	9 courses high.....24
4 courses high.. ..10¾	etc

The rules governing the construction of building masonry also apply in furnace work, i.e., the bricks should be in bond,

*From *The Iron Age*, Oct. 15, 1908.

and, if possible, none of the vertical joints of the alternate courses should meet. The latter rule is, however, not strictly observed in the bond usually employed in the furnace walls, in which for five to nine rows of alternate stretchers one row of header is used as face bond, Fig. 2. It takes much less time to build and practically answers the purpose as well as a better bond, being more or less temporary as compared with the life of furnaces in general. As a rule, all brickwork should be topped off with headers or a row lock, Fig. 3, to prevent the breaking out or falling out of bricks in the top layer.

The principal tapering shapes are further known as wedges, side arch and key bricks. In the wedge shape the sides taper toward the ends, while in side arches the sides taper toward the edges. Both shapes are extensively used in forming arches and circles. The key brick, whose edges taper toward the ends, are the shapes mainly employed for circular walls of coke ovens, lining of blast furnaces, etc. The accompanying table of taper bricks will be found convenient for practical reference. Other very important shapes are enumerated in a separate table.

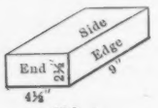


FIG. 1

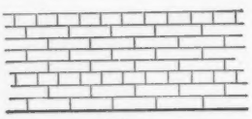


FIG. 2

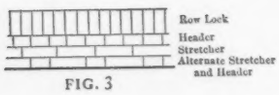


FIG. 3

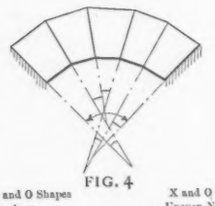


FIG. 4

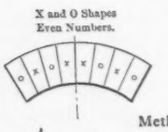


FIG. 5

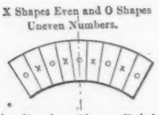


FIG. 6

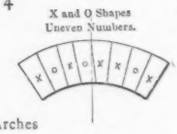


FIG. 7

Method of Distributing Shape Bricks in Arches

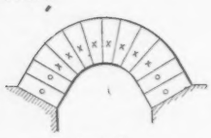


FIG. 8

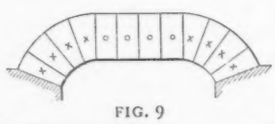


FIG. 9

USE OF STRAIGHT AND SHAPE BRICK IN WALL AND LOCK CONSTRUCTION

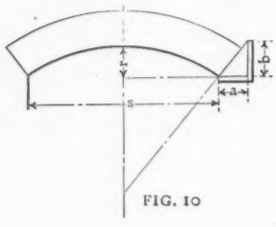


FIG. 10

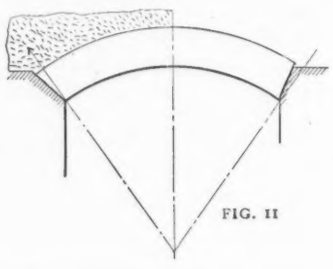


FIG. 11

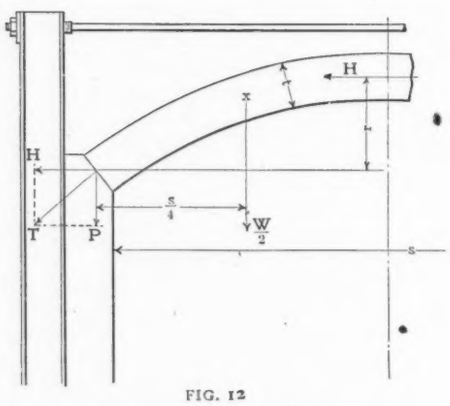


FIG. 12

DETAILS OF SKEWBACKS

Rules for the Construction of Arches and Circles

The construction of furnace arches according to best practice involves several problems. Arches and circles of various radii or diameters are built by proper combinations of the different taper bricks and the use of straights for enlarging. Evidently the sum of the included angle of all the single bricks equals the total angle of the arch between the skewbacks, as in Fig. 4. For a complete circle the total angle is naturally 360 deg., and the sum of all the taper-brick angles used to form the circle will have to check up with the total angle of the circle. This gives us an easy method for figuring the proper angle of skewbacks, also a quick method by which to choose the taper and number of bricks to suit a certain skewback.

The accompanying table gives the number of bricks required to form circles of various diameters, and is intended for ready reference. For circles in general the number of taper bricks is derived from the equations below, wherein

r = the inner radius of circle in inches.
t = the thickness of circle in inches.
x = the number of adopted X shapes tapering b to a inches.
y = the number of adopted Y shapes tapering d to e inches.

The outer circumference is then

$$C = 2\pi\,(t + r) = b\,x + d\,y,$$

and the inner circumference

$$c = 2\,\pi\,r = a\,x + e\,y.$$

Solving both equations for x, we have:

$$x = \frac{2\,\pi\,(et - dr + er)}{eb - ad}.$$

Or

$$x = \frac{2\,\pi}{b}\ \frac{et - bt + er}{e - a}$$

if d equals b, as is ordinarily the case.

For the number of Y shapes we have similarily:

$$y = \frac{2\,\pi\,(at - br + ar}{ad - eb}$$

and

$$y = \frac{2\,\pi}{b}\ \frac{at - br + ar}{a - e}$$

if again d equals b.

The figuring of arches having the span s, the rise r and the angle a of skewbacks can be conducted on one of two plans. The first is to make a test by the conditions involved in the equation

$$c = a\,x + e\,y,$$

which is to say, the length of the inside arc should equal the sum of the a and e lengths of the X and Y bricks used. Further, the sum of the angles of these shapes should equal twice the complementary angle of the skewbacks, i.e.:

$$\Sigma < (x + y) = 180 - 2\,a.$$

By a few trials it will be possible to arrive at figures checking with both equations.

The other plan is more direct and much similar to the former calculation of circles. Here the length of the outer arc C and that of the inner arc c, previously calculated from tables, are substituted in the general equation

$$x = \frac{e\,C - d\,c}{eb - du},$$

or for

$$y = \frac{aC - bc}{ad - be}.$$

It is much quicker and more accurate for the determination of the number and sizes of shapes required in an arc to use a little of the simple mathematics given than to rely only on a big scale layout, which according to my experience is seldom practically close enough.

After knowing the exact number of brick shapes required for an arch, it is necessary to distribute them in such a manner as to form a symmetrical arch,

Figs. 5, 6 and 7, also a strong arch. From the sketches of arches in Figs. 8 and 9 it is evident that even though both the same kind and number of shapes are used, the arch in Fig. 8 will be much stronger than the other. In distributing the shapes the tendency should be to throw those of greater taper toward the crown of the arch. Under any conditions a practical bricklayer will never use a greater number of straights than about 50 per cent. of the total required for an arch. Straights and taper brick should interchange as much as possible, and two straights should be avoided, because they often cause the easy slipping out of single bricks and the consequent failures of arches.

The most natural form of a roof and such arches as are not subjected to other loads is the curve in which a perfectly flexible rope will hang, i.e., the catenary curve. Building a flat-roof arch to the customary circular form of the false work is really not a mistake, for under the high temperature any arch will change its curvature and rise from the influence of the expansion of the bricks and tend to open up at the joints of the back, in many instances also causing the collapsing of a roof arch. Sand distributed on top serves here as the only effective means of keeping the arch bricks relatively in place, besides helping greatly to hold the heat in the furnace.

TABLE OF BRICK REQUIRED FOR VARIOUS CIRCLES.

Inside Diameter of Circle.	Wedge Brick.				Side Arch Brick.				Key Brick.				
	No. 2 Taper 2⅜" to 1½"	No. 3 Taper 2½" to 2"	9 inch Straight.	Total.	No. 2A Taper 2⅜" to 1½"	No. 1A Taper 2½" to 2"	9 Inch Straight.	Total.	No. 4 Taper 4½" to 2½"	No. 3 Taper 4½" to 3"	No. 2 Taper 4½" to 3½"	No. 1 Taper 4½" to 4"	Total.
1′-1½″					28			28					
1′-3″					25½	5½		31					
1′-6″					23	11		34	25				25
1′-9″					18½	19		37½					27½
2′-0″					14	27		41	17	13			30
2′-3″	56			56	11	34		45					32
2′-6″	51	9		60	8	41		49	9	25			34
2′-9″	48½	15½		64	4	48½		52½					36
3′-0″	46	22		68		56		56		38			38
3′-3″	42½	29		71½		56	4	60					40
3′-6″	39	36		75		56	8	64		32	10		42
3′-9″	35	44		79		56	11½	67½					44
4′-0″	31	52		83		56	15	71		25	21		46
4′-3″	26	60½		86½		56	19	75					48½
4′-6″	21	69		90		56	23	79		19	32		51
4′-9″	18½	75½		94		56	26½	82½					53
5′-0″	16	82		98		56	30	86		13	42		55
5′-3″	10½	91		101½		56	34	90					57
5′-6″	5	100		105		56	38	94		6	53		59
5′-9″	2½	106½		109		56	42	98					61
6′-0″		113		113		56	46	102			63		63
6′-3″		113	3½	116½									65
6′-6″		113	7	120							58	9	67
6′-9″		113	11	124									69
7′-0″		113	15	128							52	19	71
7′-6″											47	29	76
8′-0″											42	38	80
8′-6″											37	47	84
9′-0″											31	57	88
9′-6″											26	66	92
10′-0″											21	76	97
10′-6″											16	85	101
11′-0″											11	94	105
11′-6″											5	104	109
12′-0″												113	113
12′-6″												113	117

Skewbacks

With respect to the proper choice of skewbacks, there are several points to consider. In the first place, having regard to scientific correctness, the skewback line should be radial. But this condition is not practicable where it is desirable to have only a limited number of stock shapes at hand. For radial skewbacks the ratio of the rise r to the span s will be, as in Fig. 10:

$$\frac{r}{s} = \frac{\sqrt{a^2 + b^2} - b}{2a}.$$

For 45-deg. skewbacks $a = b$ and

$$\frac{r}{s} = 0.207.$$

The furnace builder will keep in mind, when not meeting the above conditions exactly, that a low skewback, shown to the left of Fig. 11, is better adapted for underground or loaded arches, such as flues, etc., while for arches not loaded, as in the case of roof arches, a slightly higher skewback, as shown on the right of Fig. 11, is to be recommended on account of its greater wedging action.

Roof arches exert a considerable thrust on the skewbacks, Fig. 12. This thrust per running foot of arch has two components, the horizontal thrust H and the vertical thrust P, which latter is simply equal to half the total weight of the roof arch. As seen in the figure, the horizontal thrust component is figured from the approximate relation

$$H = \frac{W s}{8 r}$$

to

$$Hr = \frac{W}{2} \times \frac{s}{4}.$$

And substituting for the weight

$$W = 128 \times s \times t,$$

if 128 is the weight of brick of 1 cu.ft.,

$$H = \frac{16 t s^2}{r},$$

in which t = thickness and r = rise of arch in inches and s = span in feet. It is easy to proportion from the above formulas the spacing of buckstaves and the size of tie rods.

"The Mineral Industry"

Readers of the JOURNAL are loyal constituents of "The Mineral Industry" and consequently are interested in the affairs of that annual publication, which has indeed come to be an institution rather than merely a publication. In the first place, we have pleasure in announcing that the response to the increase in the price of the volume, made last year, was such that the publication is to be continued. Its future is entirely in the hands of its friends.

This article is written to answer some inquiries as to how the work in connection with "The Mineral Industry" is done in so short a time. In outlining the magnitude of the work it is useful to quote from an editorial in the JOURNAL of Aug. 22, 1908, as follows:

"The average scientific or technical treatise is a work of about 400 pages, with about 400 words to the page. From the time when the manuscript is received from the author to the time of the publication of the finished volume, there is usually a peroid of six months. "The Mineral Industry" is a volume of upward of 1000 pages, and 500 words go to the page. Its publication is executed in the period of six to seven months, which includes not merely the putting of the book through the press, but also the preparation of the entire manuscript and the collection of its multifold statistics, the latter work alone involving the writing of thousands of letters and telegrams and the coördination and tabulation of the statistical reports."

Considering merely the bulk of the products, "The Mineral Industry" is, therefore about three times the size of the average technical treatise.

The work of bringing out a volume of "The Mineral Industry" up to the time of furnishing the complete manuscript comprises the following:

1. Collection of statistics by direct reports from the producers and consumers. This involves sending out thousands of letters and handling the replies thereto. Comparatively few of the letters of re-

quests are printed circulars, the bulk of the letters being actually written. Many of the blanks are improperly filled out by the respondents and special correspondence must be undertaken to settle uncertainties. This work cannot well be inaugurated before Feb. 1, because at the offices of many companies reports from the mines and works are not received until about that time. We have found by experience that if requests for statistical reports be sent out earlier than they can command immediate reply, they are apt to be put aside and forgotten, which multiplies the correspondence. Even as it is, a great deal of special writing must be done to tardy producers, but we are pleased to say that the majority extend their interested coöperation and are prompt.

2. Collection of the statistics of foreign countries. In some cases these are also obtained by direct reports from the producers, but in general the official reports of the foreign government are used. It is desired always to give the statistics for the last calendar year. In some cases the foreign statisticians are two years behindhand, and then, of course, we must be content with the latest figures that they can give. Among the prompter, some of the official reports reach us by May, which is in ample time. We aim to publish "The Mineral Industry" as early in the year as possible. However, if we should publish it too early it would be inevitably deficient in information. We have decided that for going to press May 31 is the date that combines the maximum of usefulness with the maximum of promptness. In some cases, where the official reports are not going to be out until June, July or August, the foreign governments are so good as to give us advance copies of their reports in manuscript, thereby saving for us the time in passing through their printing offices, without anticipating their own publication. Of course, all of this also involves a great deal of correspondence.

3. The bulk of the commercial and industrial reviews are prepared in this office. Hundreds of letters have to be written to obtain the necessary information. Incidentally, we may remark that throughout the year the newspapers and technical exchanges are carefully scanned and clipped, and the clippings are filed under an adequate system for use at this time. In many cases the clippings are reliable; in other cases, they are merely suggestive and lead to correspondence for verification, etc.

4. The nature of the special technical articles, other than the regular reviews of progress in the arts, is determined and arrangements are made with the desired contributors. Of course, this is generally done previous to Feb. 1. But after that date there is inevitably an extensive correspondence with the contributors, of whom the number to Vol. XVI was 105. Besides the work of the outside contributors, a large part of the reviews are written by our regular staff. The matters of editing the MSS., reading the proofs, coördinating the whole, etc., including keeping track of the work (not the least of the details) we shall not go into here.

We come now to the matter of putting the book through the press. We plan a volume of about 1000 pages, of which about 100 are devoted to the foreign statistics and general matter that may here be dismissed from consideration. This leaves about 900 pages of straight text.

This determination of size is not based upon any mechanical reasons (although it is desirable to have a book that will be mailable without having to use unpleasantly thin paper); it is the maximum that the present editor can supervise. We send the first "copy" to the printer on Feb. 15, and expect to have the last piece of "copy" in type on May 31. This means doing the the whole composition in 15 weeks, or at an average rate of 60 pages per week, which is conformed to as nearly as possible. The printer can do the type-setting much faster than 60 pages per week; indeed it is difficult to prevent him from accumulating "copy" until he can run off 200 pages in a few days. The controlling factor here is that we cannot revise proofs, etc., faster than 60 pages per week.

We cannot always supply required statistics when the "copy" goes to the printer. Perhaps the figures will be filled in on the galley proof; perhaps not until we receive the proof in pages; invariably a large number of pages are being held on May 31, awaiting figures. If the manuscripts were held back until complete in all respects, the book would be a year "in the pickle."

Another factor that contributes to promptness is the preparation of the manuscript, and composition of the same, so far as possible in the alphabetical order of the chapters. The result of this is that the chapters on aluminum and antimony may be printed and in the bindery, awaiting the arrival of the last sheets, before zinc has been completed.

Thus it will be seen that every week after Feb. 22 the available space is diminished by 60 pages, and that if we do not receive the several manuscripts at the required times we shall be to some extent delayed; also if manuscripts come in late and greatly exceed the estimate of their probable length, we shall also be in trouble Of course, we can never operate strictly according to schedule. We have always to leave gaps for some belated articles. (In that case the article must of necessity be cut down to fit the gap; we never leave too big a gap.) But the fewer gaps we have to leave, the smoother is the progress of the book.

We aim to have everything in type on May 31, in which event the book will be out before the end of July, something like two months being required to revise the last proofs, print, and bind. If everything were in the best possible shape on May 31, it might be possible to bring out the book in the first week of July, which some year we hope to accomplish.

Rope Driving

By Sydney F. Walker*

Rope driving is arranged in two ways. In America the method preferred is to carry a single rope from pulley to pulley as many times as there are grooves in the pulleys, the ends being then spliced together so as to form one endless rope. In the United Kingdom, the method preferred is to have as many endless ropes as there are grooves in the pulleys. In my opinion, the American method has the great advantage that all parts of the rope take their share of the strain, and therefore, as compared with the English method, a smaller number of turns should be able to do the work. In the English method it is supposed that each rope takes its share of the work, but in practice it is always found that a portion of the ropes are tight, doing the work, and the remainder slack. What happens is that the ropes which are doing the work at any instant become stretched, and gradually fall out of service; the other ropes then gradually take the work up, then they become stretched, and fall out of service, and so on. But the practical point appears to be, that twice or three times the number of ropes that could perform the drive must be present. It is claimed for the English method that it is more easily cleared, if a rope breaks, for with the American method, if the rope breaks, there is a very much longer length of rope to give trouble.

Transvaal Gold

The gold production of the Transvaal in January is reported by cable at 615,113 oz. fine, or $12,714,386. The output was 45,487 oz. less than in December, but the production of that month was swelled by the inclusion of reserve gold and other additions. A fairer comparison is with November, and the January production exceeded that of November by 740 oz. It was greater than that of January, 1908, by 54,784 oz. During the month there was some interruption of production by the floods on the Rand, which interfered with operation of mines and mills.

The Robinson mine in the Transvaal reports for 1908 a total profit of $5,500,000 from its mill of 220 stamps.

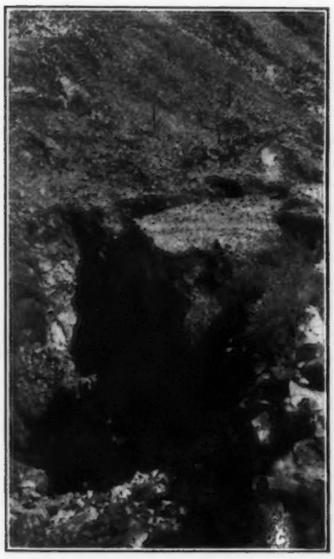
*Consulting engineer, Bloomfield Crescent, Bath, England.

Glory-Hole Mining at DeLamar, Nevada

The Material Is Drawn from an Old Widened Ore Chute, the Total Cost of Extraction Being Less Than Thirty-four Cents per Ton

BY W. R. WARDNER*

The De Lamar mines are situated 30 miles west of Caliente, Nev., a division point on the Salt Lake route, and have been worked for the last 14 years. The Bamberger De Lamar Gold Mines Company, controlled by Salt Lake and New York men, has operated the property for the last six years. The company owns its own electric power plant, situated on the railroad at Stine. Utah coal is used as fuel and the power is transmitted to the mine 13 miles away. There are 14 miles of pipe lines and four pumping stations to supply water to the town and works. All supplies for the mine are hauled from Caliente over a very fair wagon road at a cost of 55c. per hundredweight.



GLORY-HOLE FROM SURFACE

DE LAMAR, NEV., SHOWING TOP OF GLORY HOLE

The country is quartzite dipping to the east at an angle of 15 deg. from the horizontal. The ore occurs in relation to a system of north and south gouges and east and west cross dikes. The ore deposits and peculiarities of mineralization are very large subjects in themselves and will not be considered in this article.

Condition of the Workings

The accompanying sketch of the glory-hole ore zone shows a part of the vein system on the plane of Level No. 6. The sections *A-A* and *B-B* give a good idea of the way the ore lies about the glory hole. In these drawings no effort is made to show the areas already stoped by square sets, for the workings are so extensive that it is impossible to make an intelligible representation.

Originally the present glory hole was a prospect raise from No. 10 level to the surface, which was later used as a mill hole and called rock chute No. 5. By years of use the chute was cut out until it was in places more than 50 ft. across. As will be seen on the sketch plan the chute lies between the southeast and southwest veins. Owing to its unusual size it was a constant menace in the extraction of the surrounding orebodies by the square-sets system. In fact stoping had been carried beyond a point of safety and it would not have been possible to take out much more ground by that method.

Assuming a workable area by glory hole down to the level No. 8, there remained in these two orebodies alone something like 250,000 tons of ore, of proved value, in pillars and backs, to say nothing of stope fillings of ore from previous years operations which could not be worked profitably when a high mill heading was maintained. To obtain this tonnage cheaply and safely was the engineering problem that confronted the management.

Method of Operation

The commencement of glory-hole operations was the caving of the stopes around chute No. 5 into the mill hole. At this time there was about 50,000 tons of rock broken down; it is evident that gravity alone will break most of the ground for some time to come. As shown in the drawings the ore will slip away from the gouges; since the formation back of them is very hard it does not slab off to any great extent. In fact there are perpendicular walls of quartzite 200 ft. high in the open-cut workings that have been standing unsupported for several years.

The broken ore varies in size from dust to boulders of very hard quartz, many of them weighing several hundred tons. Up to date practically the only expense for breaking ground has been in handling these boulders. There is considerable waste in the ore, most of it being gouge and dike matter with some country rock. It has been found more economical to neglect the small waste entirely, and the only sorting that is done is to pick out the larger pieces. By so doing the dirt is handled quickly and at a low cost.

On account of the very large tonnage of broken ore contained in the glory hole—20,000 tons most of the time—it is advisable to draw the ore in such a manner that the grade will average fairly high, and with this end in view it is customary to attack the pile at any convenient entry in the upper levels, being governed by the position of the better ore. For instance, if the rock in the lower part of the hole is of low grade, and there is a cave of better ore on top, instead of waiting for this to be drawn down to the level No. 10,

*Mining engineer, Hollywood, Cal.

as large a part of the tonnage as necessary is tapped from entries on the upper levels. In this way a steady output is maintained without any material sacrifice of grade.

Handling Material

The sketches showing the sorting chambers and entries on level No. 10 give a fairly clear idea of the arrangements for handling and sorting this material in the most economical manner. The broken rock is drawn down upon 10x12-ft. shoveling plats, the larger waste is thrown into the waste pocket and the ore into the ore pocket. There are four of these chambers. It often happens that a large boulder comes down and completely blocks a chamber; this must be broken up, the other chambers being used in the meantime in making the required output. The train draws the pockets as needed, usually twice a day. The method of handling the rock on the upper level entries is about the same with the exception that the waste must be laid aside, the ore loaded into smaller cars and run to the nearest mill hole, and the waste to the waste hole.

The danger is small, for about all the men have to do is to protect themselves from a run of rock in the breast of the room. Most of the time they are working under cover. There is some risk in blasting the boulders when a chamber is blocked; but for an intelligent miner accustomed to this work the danger is not great.

Costs

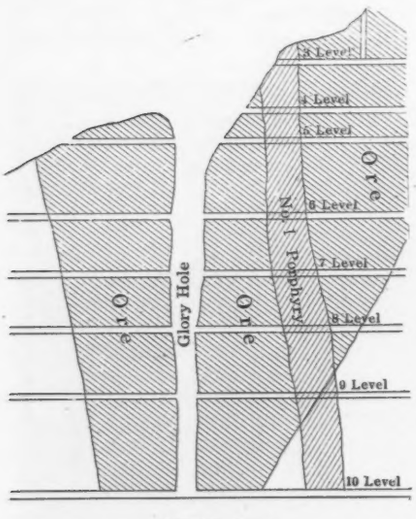
The accompanying tables of costs are for five months' operations. During this time the glory-hole ore amounted to 58 per cent. of the mill tonnage; the other 42 per cent. was obtained from the stopes, 86 per cent. from square-set stopes, 6 per cent. from stull stopes, 4 per cent. from fillings, and 4 per cent. from development. For this period the mill monthly average was 9800 tons.

COST OF PRODUCING GLORY-HOLE ORE
(28,400 Tons).

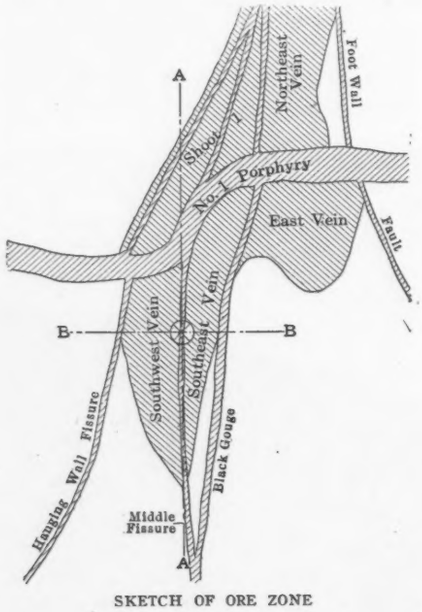
	Amount.	Per Ton.
Labor (handling and sorting)	$7,958	$0.280
Labor (haulage to mill)	1,137	0.040
Powder, fuse and caps	258	0.009
Candles	191	0.007
Hardware and tools	13	0.000
Total	$9,556	$0.336

CONTINGENT EXPENSES OF MINE
(48,900 Tons).

	Amount.	Per Ton.
Foreman and shiftbosses	$4,499	$0.092
Tool dressing and nipping	5,281	0.108
Track and pipe work	1,027	0.021
Hoisting (men, timbers and tools)	1,858	0.038
Compressed air	4,401	0.090
Assays	2,103	0.043
Surveying	334	0.015
Total	$19,903	$0.407



SECTION A—A



SKETCH OF ORE ZONE

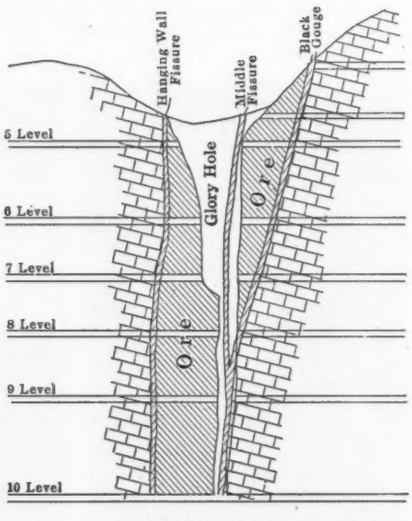
COST OF PRODUCING STOPE ORE
(20,500 Tons).

	Amount.	Per Ton.
ORE BREAKING:		
Labor	$12,435	$0.606
Powder, fuse and caps	3,144	0.153
Candles	332	0.016
Hardware and tools	130	0.007
Total	$16,041	$0.782
TIMBERING:		
Labor	$3,840	$0.188
Lumber (plank) $4,649.94		
Round timber 30c 532.20		
Pole lagging 20c 52.40		
	$5,235	$0.255
Operating sawmill	305	0.015
Hardware and tools	230	0.011
Total	$9,610	$0.469
HAULING AND MUCKING:		
Labor (including haulage to mill)	$12,217	$0.596
Operating electric haulage system	876	0.043
Candles	335	0.016
Hardware and tools	58	0.003
Total	$13,485	$0.658
Grand total	39,136	$1.909

COMPARISON OF COSTS PER TON.

	Stopes.	Glory Hole.	Run of Mine.
Cost of producing	$1.909	$0.336	$0.996
Contingent expenses	0.407	0.407	0.407
Total mine cost	$2.316	$0.743	$1.403

From these tables it appears that there is a margin of $1.57 per ton in favor of the glory-hole product, a large difference in itself. The system allows a profit on exceedingly low-grade material. It is evident that even should the value of the glory-hole ore fall so low that there would actually be no profit, so long as there is no loss, it would pay to continue operations by this method, since the cost of producing the run-of-mine ore is so greatly reduced that it is possible to make the maximum profit from the better-grade ores such as the mine affords.



SECTION B—B

C. D. Leslie, general manager for the Simmer & Jack Proprietary Mines, in the company report for the year ending June 30, 1908, states that, while the cost of recruiting and repatriating the Chinese laborers has been great, the remarkably high standard of efficiency attained by them proved a valuable object lesson to the native "boys," and he attributes the increased efficiency of the Kafir "boys" in a great measure to the example of the Chinese. While the Simmer & Jack company employs more Chinese than any other mining company on the Rand, still by reorganizing the work to the best advantage the number of Chinese employed was gradually reduced during the year without any diminution in profits.

It is not always an advantage to connect several mines, for often the ventilation becomes poorer than before, since the farther the air travels through mine workings the more it becomes vitiated.

Mining in Spain

A recent consular report gives figures for the mineral production of Spain during recent years. With the exception of coal the statistics are those of export.

In metric tons the exports of iron ore and pyrites in 1907 were: 9,966,135; in 1906, 10,349,619; in 1905, 9,349,869. Nearly half this tonnage was exported from Bilbao, Santander and Cartagena handling nearly a million tons each. Spanish iron ores are of unusually high grade, those from the Calasparra mines, in Murcia province, averaging a little above 60 per cent. metal with low sulphur and phosphorus. The Bilbao district is declining, and in 30 years will probably be worked out. From the mines of Asturias, which last year produced about 60,000 tons, an increased output is expected; and when the port of Musel is completed, five years hence, it should be possible to ship upward of 200,000 tons. There are other large deposits in Burgos province and in the Sierra Menera, but their situation for foreign transport is bad.

Of coal Spain in 1906 produced 3,095,043 tons; almost the same amount in 1905. In this field the English industry predominates, the imports last year being 2,544,466 tons.

Spain does a considerable business in tin plate in connection with the Gallician sardine-canning industry. About 20,000 tons is the annual consumption. The imports from England last year were 4475 tons, the rest came from the Hornos, Basconia and Lugones copper works. The product is said to be inferior to the Welsh plate. A duty of 140 *pesetas* per ton protects the industry. In 1907, 254 tons were exported, as against 94 in 1906, and 79 in 1905.

The north of Spain being productive of rich iron ores and fuel, the iron and steel business has grown important. In 1906 379,241 tons of pig were produced from 790,177 tons of ore, and about 200,000 tons of steel was made. The Sociedad de Altos Hornos de Vizcaya and the Sociedad Metallurgica Duro-Felguera are the chief works.

With 185,000 tons, Spain reached the second place among the world's producers of lead last year. Lead is mined in the southern provinces of Jaen, Murcia and Almeria, the chief center being Linares. But much business is done around Cartagena, where the Linares, Mazarron and Gurrucha ores are smelted. Lead exports for 1907 were 170,131 tons.

The Almaden mines increased their output of quicksilver in 1907 to about normal, i.e., 1500 tons, the average grade of cinnabar treated being 9.6 per cent. A recent commission reported that there were 400,000 tons of mineral above the twelfth level, and twice that amount below, and considered that the Almaden was well able to control the market.

The export statistics for 1907 of other mineral products were, in tons, as follows: Calamine, 33,882; antimony, 362; copper, 1,239,874; manganese, 67,997; zinc 1391; blende, 120,184.

The 1907 figures for copper show an advance over those of 1905 of about 25 per cent.

Petroleum was worked in Cadiz province during the year, and some prospecting was done elsewhere.

The production of sulphur for 18 months ending December, 1907, was 6000 tons, a reduced output due to the flooding of the mines.

In Alicante the Torrevieja salt mines produced nearly 140,000 tons; the salt pans of Cadiz about 250,000.

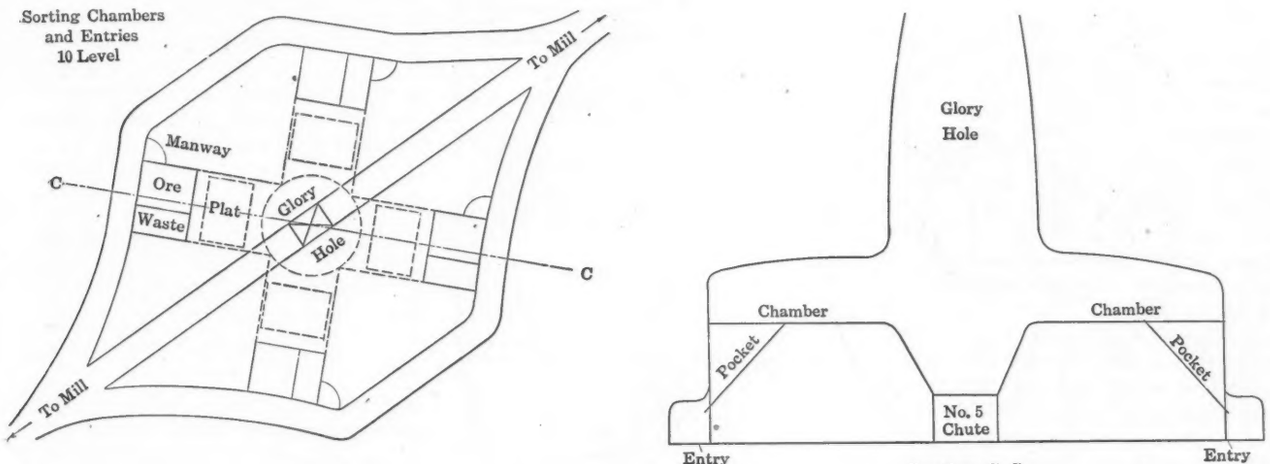
An increasing emigration due to low rates of wages has led the government to pass a restrictive emigration law, which, it is hoped, will stop the drain.

There is a 3 per cent. tax on the gross output of all mines, and the authorities have experienced considerable difficulty in collecting it. They are making experiments for the payment by mine-owners of lump sums. Foreign mining companies in Spain are likely to be seriously affected by the proposed measures restricting mining work to native engineers.

Moderate-Pressure Air Compressors

SPECIAL CORRESPONDENCE

Owing to the great demand for moderate-pressure air compressors for industrial air blast and exhauster service the General Electric Company has designed a centrifugal type of fan and is now prepared to furnish a line of standard centrifugal air compressors with pressures rated from 0.98 to 4 lb. per sq.in. and in capacities from 750 to 10,000 cu.ft. of free air per minute.



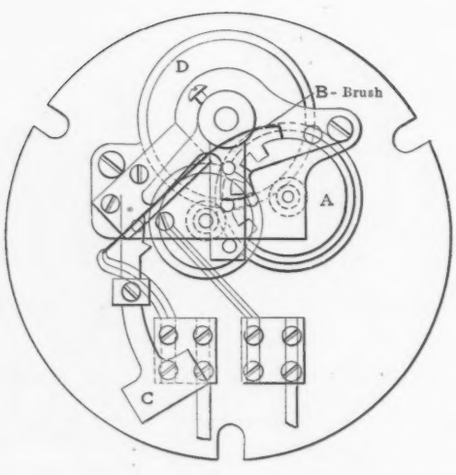
ARRANGEMENT FOR HANDLING AND SORTING MATERIAL ON NO. 10 LEVEL

In appearance and in operation this type is similar to the well known centrifugal pump for it consists of a rotating impeller surrounded by a suitable casing with an intake opening at the center and a discharge opening at the circumference. For driving these blowers hydraulic turbines or directly connected motors using either alternating or continuous current are used. The pressure in the mains leading from the compressor is entirely free from pulsation and practically constant for all volumes within the rated capacity of the compressor. Contrary to the results obtainable with positive pressure blowers, the power required to drive these so-called centrifugal compressors is said to vary approximately with the volume of air delivered when operating at a constant speed. This fact gives a greater flexibility and improved economy to the centrifugal type where variable loads are required, satisfactory efficiency being obtained between the limits of 25 and 125 per cent. of the rated load.

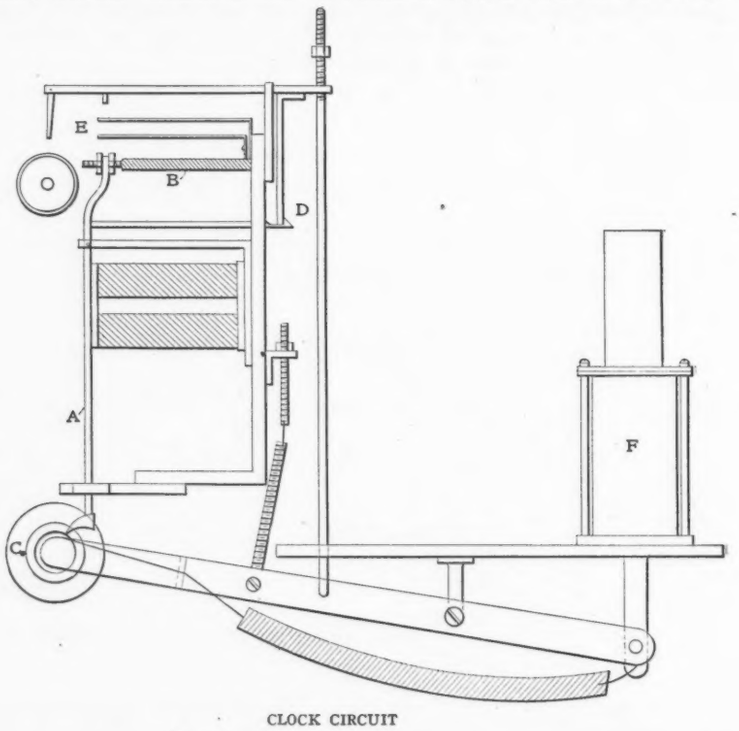
Electric Recording Apparatus for Mine Watchmen

By Carl L. C. Fichtel*

An electric system for recording the movements of watchmen is installed and in operation at one of the deep shafts of the Calumet & Hecla mine. The apparatus is operated by means of electromagnet, current being obtained from storage batteries at 30 volts and a flow of 75 m.-amp. In the shaft there are at present 49 stations, representing the beat of seven watchmen and necessitating the running of seven complete circuits. All wires leading down the shaft are encased in a 1½-in. pipe. At each level, or station a junction box is placed, with a ½-in. pipe tap leading off to the station box and in which the electrical connections are made in series. The station boxes are of cast iron, and contain a clock-like mechanism mounted on a porcelain base and actuated by means of a spiral spring. These boxes are constructed so as to be as nearly moisture proof as possible, but the extreme variations of temperature caused considerable moisture to collect within the boxes and caused the steel parts to rust. This one disadvantage was overcome by filling the chamber with oil.



STATION BOX MECHANISM



CLOCK CIRCUIT

Surface Equipment.

Besides the recording apparatus with its switchboard, the surface equipment includes two sets of portable storage batteries and a motor-generator set for charging, together with the necessary switchboard. The storage batteries are composed of 15 cells each, each cell containing nine 6x8-in. plates inclosed in a glass jar. The motor-generator set consists of a three-phase, 440-volt induction motor, direct connected to a 3-kw., 30-volt direct current generator.

The switchboard panel for controlling the charging current has a voltmeter and an ammeter so connected that a reading on either set of storage batteries or the generator may be taken, and the voltmeter can also be used to get a ground reading on any of the underground circuits. This switchboard also contains controlling switches, a rheostat and two I. T. E. circuit breakers.

The time element of the recording apparatus consists of a clock operated by means of heavy weights. Geared to this clock and in such a ratio as to make one complete revolution in eight hours, is a brass roller, 30 in. long and 20 in. in circumference; on this roller is fastened the log, or sheet, upon which the numbers corresponding to the underground stations are stamped. This log is a record for 24 hours, from 6 p.m. to 6 p.m. and is divided into spaces, each representing 10 minutes. It takes records of the movements of 30 watchmen.

The electrical arrangement consists of two independent circuits; the one leading from the apparatus to the underground boxes is a closed circuit and the one contained within the apparatus an open circuit.

Method of Operation.

By referring to the accompanying sketch of the station box mechanism it will be seen that the circuit is opened and closed through the wheel *A*, this wheel or any part of the mechanism being one side and the brush *B* which is insulated from it, the other. By turning the key one turn the spring is tightened, which then gradually works back, causing the wheel *A* to make one complete revolution and breaking the circuit the same number of times as there are notches in this wheel. The time of making this revolution is controlled by the pendulum *C*.

After the watchman has turned his key one complete revolution, the movements of the mechanism within the box are beyond his control; the winding device consists of a rachet and arm placed on the under side of the box cover. The spring does not begin to actuate the movements until the shaft upon which it is fastened is turned to a point where it catches, by means of a dog, the drive gear *D*, but simultaneously the arm is released from the ratchet, and any further turning of the key cannot hinder the action of the spring until the normal position has been resumed and the number of the station recorded.

The opening and closing of the circuit causes the arm *A*, which is held against the tension of the spring *B* by the pull of the magnets to operate back and forth and consequently to move the type wheel forward a number of spaces corresponding to the number of breaks. The instant this circuit is opened and the magnets release the catch *D* it drops, allowing the projecting point of the arm to fall on the ribbed roller. This roller is connected by means of a sprocket and chain to the clock and allows the arm to work slowly down, and its weight to bring the two points of the local, or clock circuit to-

*Calumet, Mich.

gether; it takes about 30 sec. to accomplish this, which gives the underground box ample time to have returned to normal position and to close the circuit.

The closing of the local circuit energizes the solenoid *F*, which causes the type wheel to be brought down with great force upon the log, thereby stamping, with the aid of an inked ribbon, the number of the station. This same movement in conjunction with the adjustable rod closes the local circuit and again brings it under the control of the underground circuit. The lever is returned to its normal position by the action of the spring and the dashpot placed above the solenoid, the plunger of which is an extension of the solenoid plunger. This is done slowly allowing time for the type wheel to be returned to its starting position by the pull of the spring placed beneath the lever.

The switchboard is composed of three panels of white marble. Mounted upon it are lightning arresters, current indicators, ammeter plugs and push-button connections for ground readings on either side of the line. There are also the double set of knife switches for controlling the two circuits.

The records made by this recording apparatus show at a glance the time at a station and also the time intervening between stations.

The Opasatika Lake District, Province of Quebec

By Fritz Cirkel*

A number of discoveries have been made on the stretch of lakes extending from the lower arm of Wendigo lake, 35 miles north of Cobalt northeast toward Opasatika lake, on the Quebec side of the line; and although their proper exploitation seems to be handicapped at present by the difficult access, they are important for the fact that they demonstrate the extension of the mineralized belt into the province of Quebec.

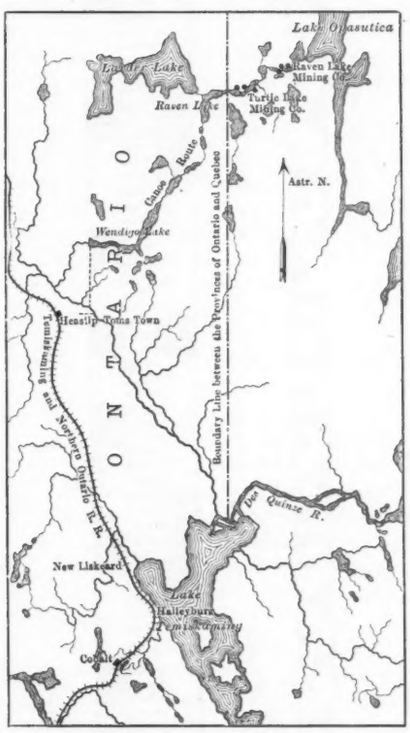
The route of travel begins at Heaslip Station, about 30 miles north of Cobalt; a stage drive over a good government road leads through Toms-Town to Wilsons Landing on the western shore of Wendigo lake, a distance of 9½ miles. Here the canoe route commences, and the trip leading through a whole stretch of lakes, ponds and rapids in high water, is somewhat hazardous. The distance from Wilsons Landing to Opasatika lake by this canoe route is about 30 miles; in low water 15 portages have to be made of which the longest is about half a mile. Under ordinary lake-level conditions these 15 portages may perhaps be reduced to about eight or nine.

Physically the country traversed is one of the roughest; low hills change with mountainous ranges, rising abruptly in cliffs over the water's edge. No agricultural land could be seen along the whole canoe route; the country is of uneven, rocky nature, and is covered almost wholly with original forests, or with a second growth of timber. Toward lake Opasatika, on Birch lake and Green lake, high, straight cliffs partly form the lake shores, and the various colors of moss covering these rocks, impart to the whole a beauty of its own.

A year and a half ago Wendigo and Raven lakes were the scene of extensive travel to Larder lake, which was reached by trail from the upper arm of Raven lake.

The Rocks

The rocks along the route belong to different geologic horizons; no special study has as yet been made of them. Along Wendigo lake the rocks seem to consist mostly of a gray-greenish conglomerate, approximately the same conglomerate as that found around Cobalt. The conglomerate is cut by dioritic and basaltic rocks, and some discoveries of cobalt have already been made in this series.



OPASATIKA LAKE DISTRICT, QUEBEC

Several years ago almost the whole shore of Wendigo lake was staked, but subsequent prospecting work showed, save for a few discoveries, that that part of the country is not bountiful in minerals. Arsenical pyrites is frequently found in the conglomerate and in one place, where more work has been done, the ore occurs in small veinlets or pockets irregularly distributed through the rock and not confined to what may be called a vein or ore lode. Whether this arsenical pyrite carries any gold I am not able to say, but the work which consisted of a shallow cut into the hillside was subsequently abandoned. Several discoveries of cobalt bloom were made, some of them carrying silver, but exact and reliable data could not be obtained.

The most important discoveries have undoubtedly been made on the shores of Turtle lake, Moose lake and Mud lake, west of lake Opasatika. Access to these locations is difficult.

Around Turtle lake the rocks consist of a greenish slate, for the most part, with distinct bedding planes; the strike varies from northeast to strictly east-west, while the dip varies from the horizontal to almost vertical. These rocks are fine-grained, and represent probably the alteration product of gabbro and dolerite. They vary in color from pale gray-green through yellowish green to dark green; they are generally rather soft rocks, yielding to the scratch of the knife.

Mineralized Vein

Fissures are numerous and are for the greatest part filled with a milkwhite quartz, carrying minute particles of iron pyrites or chalcopyrite. These quartz veins either occur as a series of parallel stringers from ½ in. up to 12 in. in thickness, or they occur as regular lodes of solid quartz, measuring all the way from 1 ft. to 70 ft. in thickness. Their general or approximate strike is east-west; their dip almost vertical. Almost all of the quartz lodes observed are metalliferous. The most frequent constituent is copper pyrites and in a less degree iron pyrite, the latter imparting to the quartz a rusty color wherever it occurs.

Altogether seven vein locations have been made, but several of the latter, according to survey, have been made in the same ore lode, and the number of metalliferous quartz veins may be reduced to four. The most important of these veins is one located on the north shore of Turtle lake. This vein strikes northeast 80 deg.; it dips almost vertically and consists of a rusty quartz carrying rich disseminations of copper pyrites, with green and blue carbonates intersprinkled; the lode is at some places 2 ft., in others 3, 5, or 10 ft., and in others it is split up into several separate quartz lodes, without, however, losing its ore.

The assay value ranges between 4.5 and 6.5 per cent. copper; in some places assays as high as 10 per cent. were obtained. Most of the accompanying country rock is impregnated with the mineral, and there is reason to believe that in actual mining operations, instead of a strictly silicious ore a semi-silicious copper ore may be produced. This ore lode has not been followed far inland, but judging from the strong character of the vein there is some ground for the assumption that its horizontal expansion is large.

*Mining engineer, Montreal, Canada.

All these locations were made close to the shore; no attempt has yet been made to follow farther inland; in fact not one discovery has been made farther than about 1000 ft. from shore.

Toward Lake Opasatika

Proceeding from the Turtle lake region along the chain of lakes toward Lake Opasatika the formation changes entirely. Instead of the greenish varieties of rock we meet fine-grained grayish quartzites, graywacke, granitoid and purely feldspathic rocks. Reddish granites are frequent and form for the most part the steep shores of several of the smaller lakes. In the vicinity of Moose lake and Mud lake quartz lodes of considerable extent have been explored; they range in width from 10 to 70 ft., the strike being mostly east-west, or nearly so. They are not auriferous, but they carry fine disseminations of copper pyrites; the quartz lodes are divided by planes parallel to the walls into several parts, each of which carries a certain percentage of the ore. One part, say, of 3 ft. may contain an average of 3 per cent. of copper, while the next division may not carry more than 1½ per cent. Exploration on these large quartz veins has not been carried far enough to allow of an average assay being taken, but from present indications it appears that a good part of some of these large veins may carry copper ore above the working limit.

The country, however, is not conveniently accessible for actual operations, and here, too, the lack of transportation facilities will prevent mining for some time to come.

All the discoveries along the stretch of lakes toward Lake Opasatika go to show that this country is not so devoid of mineral deposits as originally supposed, and it is likely that in the course of time additional discoveries may be made, which may induce the Quebec government to do something in the way of furnishing proper transportation facilities.

A Novel Stadia Rod

By J. H. Granbery*

In preliminary surveys and often in more accurate work, the use of stadia measurements is rapidly increasing. This is primarily due to the convenience of such methods, as well as to the saving of time resulting; such measurements compare favorably for accuracy with ordinary chaining, and bring the responsibility for the work directly to the instrumentman who is generally more accurate and careful than the subordinate chainmen. Stadia work has, however, been limited to sights of 1000 ft. or less. Beyond this distance most of the characters upon the ordinary stadia rod are so indistinct that the rod cannot be read; at even less distances the red characters appear black, and the figures used to denote the unit divisions are confusing and often illegible.

In surveying marshy islands on the Georgia coast, the interior of which was often inaccessible, a system of primary triangulation was used for the establishment of points from which measurements might be taken and referred to the base lines used in the triangulation system.

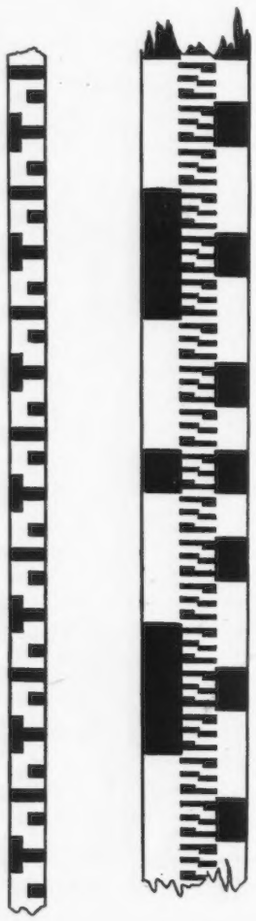


FIG. 1

FIG. 2

The base lines were chained with great accuracy in every instance, but the character of the shore was prohibitive of meandering, or of instrumental determination using only one instrument, unless stadia measurements were resorted to. The ordinary stadia rod was tried, but, except in a limited number of instances, the length of sight required was too great for its use. Accordingly, I designed for the work a stadia rod which has several novel features.

A Rod Without Figures

The method of division is the striking feature of the rod. It was developed after trial of various forms and has proved of accurate service in the measurement, by a single sight, of distances as great as 3800 to 4400 ft. The rod has *no figures*; the divisions being indicated by characters of varying form, but each foot of division bears the same characters, in the same relative position, as every other foot. In practice it is found easier to count the divisions than to decipher a printed figure; indeed, counting divisions is itself dispensed with after a short use of the rod, as the *location* of signs, rather than the counted divisions guides the instrumentman, in much the same manner that time is usually read by the position of the hands on the clock face rather than by reference to the numerals. Consequently, readings may be made with great rapidity.

Divisions

The rod is divided as shown in Fig. 1, the T-shaped characters being used for the major divisions; the stem of the T is 0.1 ft. in vertical width, and the arms extend 0.1 ft. beyond the stem. Each of the minor divisions is also 0.1 ft. in vertical width, and reference to the figure will show that by the grouping adopted every tenth of a foot is marked by the edge of a solid black figure so that the rod is easily read at a considerable distance.

Subdivisions into 0.01 ft. are made by the small forms or characters shown in Fig. 2; each of these is so formed that the division is at the edge of a solid black figure, in the same manner as provided for the tenths divisions. By making the divisions as shown it is seen that reading to half tenths, or to fiftieths, is facilitated; hundredths are also equally prominent and read with the same degree of ease. The fact that every hundredth is represented by a different combination of length, or position, of the edge of the character makes the reading as plain, after practice, as if the numeral itself were seen. By placing the characters representing feet and tenths at opposite edges of the face of the rod for alternate feet the reading may also be facilitated, as all the even feet divisions are then at one side and all the odd feet divisions are at the other side. This has been found unnecessary in practice, however, as the characters are so clear and distinct that mistakes of observation are rarely due to reading.

In making the sights referred to, a rod 23 ft. long was used; it was made of two long strips of light, dry wood, secured to each other in the form of a T so as to prevent warping and twisting. The rod was handled by one man, and the readings were made first between the lower stadia wire and the horizontal cross-hair, and then (without removing the eye from the telescope of the transit) between the cross-hair and the upper stadia wire. The mean of the two readings was used—with an instrument in perfect adjustment a single reading, however, would suffice.

*Consulting civil engineer, 20 Broad street, New York City.

Sand Boils

By J. J. Fred Brand*

There seems to be but little published information on the subject of sand boils. An explanation of their causes, and a method of preventing them, which works well in practice, came only after much thought and many experiments.

The furnace at which the experiments were conducted is of the air, or reverberatory type, having a capacity of 10 tons. The blast is supplied by a fan blower through a 9-in. pipe which leads to the ash pit. A 70-ft. stack, 48 in. in diameter carries off the products of combustion.

The hearth, which measures 12x6.5 ft., is separated from the firebox by a 16-in. bridgewall, built 22 in. higher than the grate bars; the opposite end of the hearth gradually slopes into the neck leading to the stack. The silica bottom is put in when the furnace is cold and is heated before charging the metal. The life of the bottom is 6 to 15 heats, before it is necessary to renew it. The first charge on new bottoms usually gave trouble. Charges of a certain analysis, melted on an old bottom, would be ready to tap at the scheduled time, while another charge of the same mixture melted on a new bottom, would remain in the furnace anywhere from one to four or more hours longer.

The following record of two such heats taken from my memoranda will serve as an illustration: The first is the record of heat No. 203, weight 5850 lb., and was the last charge melted on an old bottom. The second is the record of heat No. 204, weight 5875 lb., the first charge melted on a new bottom.

No. 1: 585 lb. of pig containing 1.58 per cent. Si; 585 lb., 1.31 per cent. Si; 585 lb., 2.21 per cent. Si; 1170 lb., 1.51 per cent. Si; and 2925 lb. scrap containing, approximately, 0.60 per cent. Si. The scrap and pig charged at 9:32 o'clock, melted in 1 hr. and 43. min., and was tapped 59 min. later. The first test was only slightly turned; this heat was tapped when the test gave a clear fracture. Metal ran well.

No. 2: 585 lb. of pig containing 1.58 per cent. Si; 585 lb., 1.31 per cent. Si; 585 lb., 2.21 per cent. Si; 1170 lb., 1.51 per cent. Si, and 2950 lb. scrap containing, approximately, 0.60 per cent. Si. The scrap and pig charged at 11:30 o'clock melted in 1 hour and 23 minutes, and was tapped 3 hours and 52 minutes later. The first test was dark speckled; 23 more tests were taken, none showing any improvement over the second test, which was somewhat lighter than the first. This heat was tapped when the test gave a clear fracture. Metal ran well.

*Findlay, Ohio.

Control of Furnace

All the constituents of the pig iron (carbon excepted) were specified, but in the absence of a laboratory it was necessary to judge the progress of the metal during the oxidation period. and the condition of the scrap, by test plugs which measured 1x1x6 in., which were cast in sand. Those taken by the melter on the platform were allowed to remain in the sand for two minutes before drawing, when they were slowly cooled by quenching in water. The first test was taken immediately after the metal was melted; the remaining tests were taken at intervals of 10 to 20 minutes. Those taken at the spout at certain intervals during the pour were allowed to cool in the sand. Thus we were able to judge within close limits the percentage of silicon in the scrap.

According to the memoranda there was but little difference in the appearance of the scrap which was charged into the above heats, but the melter's first tests show that melt No. 204 contained a little less silicon than melt No. 203 at the time charges were melted.

Those first heats were dreaded, except when some new remedy was to be tried; we were many times led to believe that a remedy had been found, only to find out sooner or later that another cause contributed to the success of that particular heat.

The general opinion was that the bottom, not being thoroughly fused, would peel off and rise to the surface of the metal, thus causing the slag to become acid from which silicon would be reduced and absorbed by the metal. In accordance with the above opinion special efforts were made to fuse the bottom thoroughly before charging.

The best grade of quartz sand was considered too refractory to be used alone; therefore, various proportions ranging from a few shovelfuls to half of the batch of a poorer grade of silica were added; at other times various proportions of fireclay or firebrick dust were added or sprinkled over the top. Crushed slag was always thrown in just before the metal was charged, that is, after the bottom had been burned well, which was (unless the fireman happened to be irregular) heated intensely.

Many trials, covering a period of two years or more, were made to solve the problem along this line, and all failed. In view of the past failures and the following evidence, the writer had reasons to believe that the above conclusion regarding the reduction of the silica in the slag was wrong.

The slag from a first melt differed from the slags of the succeeding melts in that it was yellow and more basic than the black slags of the succeeding melts, as the following analysis will show:

No. 1 is a yellow slag from a first melt on a new bottom, while No. 2 is a black slag of the succeeding melts.

	No. 1, Per Cent.	No. 2, Per Cent.
SiO_2	37.05	51.52
Al_2O_3	16.30	18.10
FeO	3.60	22.90
MnO	1.65	1.85
CaO	32.11	3.81
Fl	8.33	trace

It is highly improbable that silicon would be reduced from No. 1 slag, when no irregularities were experienced from No. 2 slag. It is also reasonable to suppose that if the silicon came from the slag, a test taken from the metal nearest the slag should give a fracture as dark as one taken after rabbling. No doubt existed in my mind at any time that the reduced silicon did not come from an acid slag, but that it came from the sides and bottom of the hearth.

There was every reason to believe that such was the case. Take, for example, the analogous killing or dead-melting stage in crucible steel manufacture, during which silicon is reduced from the walls of the crucible; provided, that the proper percentage of silica is present in the walls of the crucible, and sufficient carbon in the iron, with the required high temperature. It is self-evident that this latter condition is present in both iron and crucible, as externally applied heat must pass through the crucible walls before the whole is raised to a casting temperature.

In malleable practice both the carbon and silica are necessarily present in such amounts as would favor the reduction, but unless the silica hearth is of a proper temperature it cannot take place. In the attempt to keep the hearth from peeling off by the excessive heating, the conditions were made ideal for the reduction of silica from it.

Finally an opportunity was taken to put the theory to test and a succeeding bottom of the best grade of silica was put in, and heated only to redness; a barrow of crushed slag was then scattered over it and allowed to melt. A mixture of the same iron which gave good results on the previous old bottom was charged, but was melted, hot, and ready to tap in 18 minutes less time than had been required for the preceding charge.

The result of this single experiment, however, was not accepted as conclusive evidence that the theory was correct; we made further trials which were satisfactory, and we have every reason to believe that the cause of the phenomena has been discovered, as no more trouble is being experienced from "sand boils."

Shipments of tin from the Straits Settlements to the United States and Europe in January were 5733 long tons; an increase of 500 tons over January, 1908.

The Heroult Electric Furnace in the United States *

The United States Steel Corporation has decided to introduce the Heroult electric furnace and steel process, its engineers having made a close study of the general subject, extending over two years, and having made a number of visits to the localities abroad where electric furnaces and methods are in operation. At the same time its patent attorneys and experts made a thorough examination of the patents and of the state of the art.

The outcome of these investigations is that it has been decided to put up one 15-ton Heroult furnace at the South Chicago works of the Illinois Steel Company and one 15-ton furnace at the Washburn & Moen plant of the American Steel and Wire Company at Worcester, Mass. Probably a furnace at Homestead will follow. At the South Chicago plant, where three-phase current is available, both locally and from Gary, the purpose is to take the blown metal from the bessemer converter and refine it in the Heroult furnace for the manufacture of a specially high grade of steel rail, the capacity of the electric furnace being about 500 tons per day of 24 hours. As to the ability of the Heroult process to eliminate phosphorus and sulphur and to deoxidize the bath, overwhelming evidence has been accumulated abroad.

At Worcester the Heroult furnace will be served by two 50-ton open-hearth furnaces, and will be devoted particularly to the refining of the metal for use for the high-grade steels which the plant requires for the many lines of special wire products.

The United States Steel Corporation will, therefore, be the pioneer in introducing electric refining both in the manufacture of tonnage products like rails and special steels for the wire industry. The quality of rails has been a burning subject in recent years, and the plan of producing what will be equivalent to tool steel quality is one which raises high hopes for the future. In fact, the question suggests itself whether the verdict in favor of open-hearth steel which has been so freely given of late may not be reversed and whether the bessemer converter backed by the Heroult electric refining furnace may not yet come to its own within the enlarged field which the ability to utilize impurer ores will offer. It is even within the range of probability that for this service the 15-ton electric furnace does not represent the maximum unit, and that furnaces of larger capacity may be found practicable.

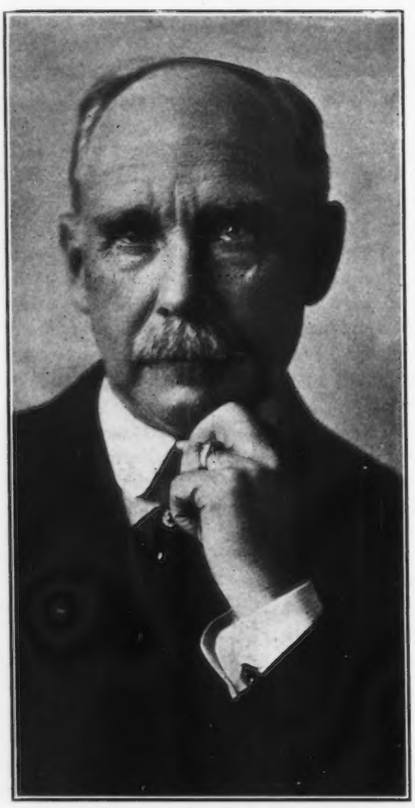
Hardly less interest attaches to the refining of open-hearth steel as at Worcester. Starting with a purer product from the steel furnace—whether it be acid with selected raw materials or basic open-hearth steel from materials of moderate purity—the electric refining process will yield a final metal very low in impurities, and thoroughly deoxidized, which will greatly raise the standard of quality.

Plans for the two plants are now being drawn, and construction will be pushed vigorously so that both installations will be in operation before the early summer.

*From the *Iron Age*, New York, Feb. 18.

D. W. Brunton

Mr. Brunton, who has just been elected president of the American Institute of Mining Engineers, was born at Ayr, Canada, in 1849. He studied engineering at



D. W. BRUNTON

Toronto, practiced three years in the East, then took a post-graduate course at the University of Michigan, and went to Colorado as mining engineer for the Dakota & San Juan Mining Company in the spring of 1875. He next took a position as engineer for the Hunt, Douglas & Stewart mill at Georgetown, Colo., where he remained until the summer of 1876, when he became engineer for the Clear Creek Reduction Works. In 1876 he went to Silver Peak, first as mining engineer and later as manager, for the Silver Peak Mining Company, and in 1880 went to Leadville, and in partnership with F. M. Taylor, built the Taylor & Brunton mill in California Gulch. The business management of the plant was placed in the hands of Mr. Taylor, leaving Mr. Brunton free to devote himself entirely to professional work, in the course of which he became consulting engineer for the Dunkin, Robert E. Lee, Wolftone and Dinero mining companies, and for a time was manager of the Colonel Sellers mine. In 1889 he became consulting engineer for the side-line mining interests in Aspen, and had engineering charge of the long and bitter litigation in that district. On the termination of the lawsuits Mr. Brunton became manager of the mines at Aspen where he remained until the spring of 1893, when he removed to Denver and opened an office as consulting engineer.

One of the most important undertakings carried on by Mr. Brunton during his management at Aspen was the Cowenhoven tunnel, a 2¼-mile double-track bore, driven under Smuggler mountain for the purpose of affording drainage, transportation and ventilation to the principal mines of the district. This work, which was attended by many difficulties, attracted the attention of tunnel engineers in all parts of the United States. A paper on the methods employed in driving this tunnel, read before the Institution of Civil Engineers, brought him a Telford medal, and the miners, to show their appreciation of the care and forethought which made it possible to carry on the work from start to finish without a single accident, presented him with an elaborately engraved gold medal.

Mr. Brunton was one of the first to perceive the defects of the old-fashioned system of determining the value of ore by hand sampling, and after an investigation of the subject, invented what is known as the Brunton mechanical sampler, which was first installed in the Mathews & Webb plant at Denver. To realize greater returns from the invention than was possible by selling it under royalty, Taylor & Brunton built a public sampling works, utilizing this system throughout, in Aspen in the summer of 1889, and later extended this business until they now have a chain of samplers in Colorado, Utah and Nevada, which is perhaps the largest business of this kind in the world.

In the course of his professional career Mr. Brunton's mining trips have taken him into most of the principal mining districts of the world. He has made examinations from Alaska to Argentina, in addition to which he has traveled through Europe, Asia, Africa, Australia and New Zealand. Among his clients have been the Mines Limited of London, the Anaconda Copper Mining Company, Amalgamated Copper Company, New Jersey Zinc Company, Rio Tinto Mining Company, of Spain, and the Drainage Association of Cripple Creek.

The Robinson mine in the Transvaal reports for 1908 a total profit of 5,500,000 from its mill of 220 stamps.

Power from Copper Blast-Furnace Gases

Furnaces at Mansfeld, Germany, Carry Nearly 20 Per Cent. Coke and Yield Gas for Power Equivalent to 7.4 H.P. per Ton of Ore Treated

BY ROBERT SCHORR*

The famous Mansfeld district near Eisleben, Germany, and the metallurgical processes employed there are too well known to require description here. Some time ago the 700th year jubilee of the copper smelting works was celebrated, the occasion being honored by the presence of the German Emperor. The present company, which amalgamated the many independent interests, was organized in 1852. Since that time great progress has been made. The yearly report for 1907 states that 524,524 tons of *Kupferschiefer* (bituminous copper schist) and 151,890 tons of *Dachberge* (nonbituminous limestone, containing small amounts of copper) were mined, or a total of 676,414 metric tons. The copper schist contains from 1.8 to 3.7 per cent. copper in the form of bornite, chalcopyrite and chalcocite, and there are also small quantities of silver. The balance consists of about 40 per cent. silica, 10.7 per cent. alumina, 5 per cent. ferric oxide, 19.5 per cent. calcium carbonate, 2 per cent. sodium carbonate and 10.3 per cent. water and bitumen. In the stated tonnage of *Dachberge* some nickel ores and sand are included. The average yield per ton of ore charge amounted, in 1907, to 2.847 per cent. copper and 0.0155 per cent. silver. More than 135,000 tons of coke, or almost 20 per cent. of the ore burden, were consumed in the matte-smelting operations.

In view of the low grade of the ore and the high cost per ton for mining and treatment (about $9), great efforts have been made to utilize all waste products. The income from such sources amounted to almost 3,000,000 marks, two-thirds of this amount having been obtained from the sale of more than 18,000,000 slag bricks. The fumes from the matte-roasting kilns yielded about 24,000 tons of sulphuric acid, ranging from 55 to 66 deg. B., and 27 tons of ferrous sulphate. Only 2867 tons of flue dust were made, or recovered, equal to 0.5 per cent. of the total ore charge treated. From this source more than 200 tons copper, 383 tons lead, carrying 0.2 to 0.3 per cent. silver and 11.7 tons of nickelspeiss were obtained. It will be noted than the flue dust yielded more than 13 per cent. lead. The dust is mixed with ground shale and pressed into bricks which are calcined with schist before being smelted. There is a small blast furnace with four tuyeres at the Eckardt plant which is run periodically for this work.

The gas-engine plant of the Krughütte furnished in 1906 almost 7,000,000 kw. hours, and somewhat less in 1907. There are also a number of boilers fired with furnace gases, most important being the new installation of three 300-h.p. water-tube boilers at the Kupferkammerhütte.

Operations of the Mansfeld Works

Tables I and II summarize the smelting operations for matte (coarse metal) at the various Mansfeld works, and they give some segregated data pertaining to average daily charges and coke consumption. Round blast furnaces with deep crucibles are used throughout. They vary in size from 5 ft. 3 in. to 6 ft. 2 in. at the tuyeres, and are equipped with bell-and-hopper feed arrangements. The feed floor is from 24 to 30 ft. above the floor level, and the connections with the gas mains are placed directly below the feed floor. Spacious dust bins are provided. Each furnace has six tuyeres, and the blast pressure ranges from 2.9 to 4.4 in. of mercury, equivalent to a pressure of 22.765 to 34.540 oz. per square inch.

The ore charge consists of 1700 lb. of roasted schist, 600 lb. *Dachberge*, 100 lb. slag and 100 lb. skimmings. Table II shows the amounts of matte produced and the grade. The work of the reverberatory furnaces is outlined in Table III. The production amounted to 19,240 tons of copper, and more than 96 tons of silver. The receipts from sales, inclusive of by-products, reached a total of $12,000,000, and the net profits were about $1,400,000. About 23,000 men are steadily employed.

TABLE I. MATTE SMELTING, MANSFELD WORKS, 1907.

Plant.	Ore Charge. Metric Tons.	Total Coke Used. Tons.	Coke Per Ton Ore. Kg.	Average Number of Furnaces in Use.	Copper Yield Per Ton of Ore-charge. Kg.	Silver Yield Per Ton of Ore-charge. Kg.	Average Ore-charge Per 24 Hours. Tons.	Average Ore-charge Per Hour. Tons.	Average Daily Ore-charge Per Furnace. Tons.
Krug-Hütte	232,510	53,245	229	4	26.92	0.153	636	26½	159
Koch-Hütte	193,700	39,708	205	4	29.51	0.150	531	22.1	135
Eckardt-Hütte	126,700	22,812	189	2 to 3	29.95	0.163	331	13.8	151.1
Cu-Kammer Hütte	130,400	19,299	148	2	28.35	0.161	356	14.8	168.5
Totals	677,310	135,064	199.8		28.47	0.155	1854		

TABLE II. MATTE PRODUCTION, MANSFELD WORKS, 1907.

	Tons.	Copper per Ton Kilograms.
Krug-Hütte	16,785	72
Koch-Hütte	11,059	59
Eckardt-Hütte	8,769	73
Kupfer-Kammer-Hütte	9,400	72
Total	46,012	

Gas-engine Power

In former years the waste furnace gases were used for raising steam and for heating the blast. The furnace gases at the first three works named in Table I have a heating value of from 590 to 630 cal. per cu.m., but in the fourth plant they are considerably poorer. The economy of central generating stations at this place is indicated by the fact that there are more than 350 steam engines representing 34,000 h.p. scattered over an area of about 60 square kilometers.

So far only the Krughütte has been equipped with gas engines. These are directly connected with electric generators, which furnish a three-phase current of 50 cycles and 3000 volts. Underground cables are employed for distribution. Table I shows that the Krug furnaces smelted at an average 636 tons of ore daily, or 26½ tons per hour. For every ton of ore approximately 800 cu.m., or 28,250 cu.ft. of gas is evolved, or 21,200 cu.m., 748,680 cu.ft. per hour for the whole charge. These quantities vary to some extent, depending entirely upon how the furnaces are operated.

The gas supply is fairly steady, as it is aimed never to have more than one furnace cut off from the mains; it is necessary to cut off the furnace while feeding. The average heat value of these gases is 600 cal. per cu.m., or about 68 B.t.u. per cu.ft. This is about two-thirds of the calorific value of an average gas from iron-blast furnaces, which always contains 1¾ to 2 per cent. of hydrogen; copper-furnace gas carries no hydrogen and consists of 9.2 to 10.8 per cent. carbon dioxide, 19 to 24 per cent. carbon monoxide, the remainder being nitrogen. The fluctuation in heat value amounts to about 10 per cent.

Efficiency

In view of the large power expenditure

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required for cleaning the gas and for the compressing of such lean charges in the engine itself, it will not be safe to figure on less than 2700 cal. or 10,711 B.t.u. per effective horsepower-hour, corresponding to a gas supply of 4½ cu.m. or 159 cu.ft. The heat equivalent of one horsepower being 736 cal. or 2545 B.t.u., we have 2545 $= E.$ 10,711 or the thermal efficiency of the gas engine $E. = 23.76$ per cent. Better performances are on record, established by careful tests made under ordinary conditions and without previous cleaning of valve chests and cylinders. Since 21,200 cu.m. of gas is available per hour, this represents a total of $21,200 \div 4.5 = 4700$ h.p. equivalent or continuously 7.4 h.p. equivalent for every ton of ore treated in 24 hours. The power equivalent for every ton of copper made in 24 hours is then $7.4 \times 37 = 273.8$ h.p., since 37 tons of ore are smelted for every ton of copper produced. In all more than 41,000,000 horsepower-hours, or more than 30,000,000 kilowatt-hours could be generated at the Krughütte alone.

The gas as it leaves the four furnaces is entirely unsuitable for direct use in gas engines, because it contains 17 grams of dust per cu.m. and also sulphur, arsenic, potassium, cyanide, etc. It is therefore, first cleaned, the two gas mains feeding from the furnaces to Theisen gas washers. There are three washers housed in one building; two have a capacity of 6500 cu.m. of gas per hour each, and one is built for 15,000 cu.m. This makes a total capacity for the whole installation, of 28,000 cu.m. of gas per hour. The temperature of the entering gases is about 300 deg. C. or 752 deg. F. About 25 gal. of water are required for every 1000 cu.ft. of gas, or about three liters per cu.m. The power consumption for every 1000 cu.m. is at an average 6 h.p. or above 2¾ per cent. of the power represented by the purified gases.

The gas contains, after cleaning, only 0.003 to 0.005 gram solid matter per cu.m. The water from the washers is run into large settling tanks, the deposits in which carry up to 25 per cent. lead. The deposits are filter-pressed and treated for lead and silver with the balance of the flue dust, as obtained from the dust chambers in the furnace building.

In the original installation, the gases, after leaving the washing plant, were passed into a gasholder of 500 cu.m. capacity. More recently a second holder of 4000 cu.m. has been added, and also gas filters placed at the engine house. These filters are similar in construction to an ordinary scrubber, but they are arranged horizontally, and instead of wooden trays, beds of iron turnings are placed vertically at intervals. The gas leaves the filters with a temperature of 21 deg. C., and it is under a pressure varying from 1 to 5 cm. of water column.

The Gas Engines

The first installation of two 125-h.p. four-cycle Kœrting gas engines has been working almost steadily since 1901. The two 1300-h.p. Oechelhauser-Borsig engines operate on a two-cycle, and are single acting. They have been continuously in commission, day and night, for more than 3½ years. The latest addition is an 1800-h.p. two-cycle Kœrting engine built by the Klein Engineering Works of Dombruch. This unit was completed last April, was placed in service June 9, 1909, and has since run satisfactorily. This completes the original plan for the Krughütte gas-engine central station, bringing it up to a rated capacity of 4650 h.p. The new large engine has a stroke of 1300 mm. and is designed for 86 r.p.m.; the 1300-h.p. engines have a stroke of 950 mm. and make 125 r.p.m. All engines are directly connected to three-phase generators of 50 cycles and 3000 volts. The two smaller engines are in a separate building.

Much trouble has been caused by fluctuations in the percentage of carbon monoxide and carbon dioxide. As long as the ratio CO_2: CO is in the neighborhood of 1:2 the engines work perfectly, the compression averaging 16 atmospheres, or 227.6 lb. per sq.in. This is very high, and only possible with poor gas, without causing premature explosions. The work of compression is correspondingly high, amounting to about 9 per cent. of the cylinder duty. The pressure of explosion is 25 atmospheres, or 355 lb. per square inch.

To assure a uniform quality of gas, or to permit enrichment in the case of a sudden rise in carbon dioxide, the company has installed quite recently two Pintch gas generators with a combined capacity of 3000 cu.m. per hour. Locomotive cinders, which average about 3500 cal. per kg., or 6300 B.t.u. per lb., are employed with coke breeze in the proportion of three to one, the cost of enrichment being only 2 pfennigs per kilowatt-hour. These generators are arranged for hand feeding. The generator gases pass through coolers and scrubbers, as in the usual standard gas plant, to remove tar, ammonia, etc. In view of the small quantity of gas which will be required for the enrichment of the blast-furnace gases, there may have been no necessity to go to this complication and expense. It is also contemplated to use at times coke breeze and brown-coal coke screenings (*Grude*) instead of locomotive cinders.

The gas-engine plant of the Krughütte has been utilized to less than its full capacity, in order to avoid temporary overloads caused by the many and widely distributed secondary movers. In spite of this the financial result has been rather satisfactory. The total expenditure for operating and fixed charges in 1907 amounted to 122,512 marks, equal to about 0.67c. per kilowatt-hour. The results in 1906 were a little better, figuring 0.51c. per kilowatt-hour, or about $33 per horsepower-year. With the full plant in operation the average yearly load factor will be considerably higher, and a further marked reduction in the power cost will be effected.

I am indebted to Otto Scharenberg, the engineer-in-charge, for much of the information used in the preparation of this article.

TABLE III. REVERBERATORY SMELTING, MANSFELD WORKS, 1907.

Plant.	Matte, Tons.		Flux (Sand-ores), Tons.	Coal, Tons.		Matte Per Day Per Furnace, Tons.	Copper in Product, Per Cent.	Silver in Product, Per Cent.	Number of Furnaces.	Black Copper Product, Tons.
	Roasted.	Raw.		Total.	Per Ton of Ore.					
Eckardt-Hütte....	25,437	1,569	647	9,535	0.353	12.89	74.3	4.08	9	25,766
Cu-Kammer-Hütte.	20,648	713	411	9,971	0.467	11.04	74.2	4.36	11	
	46,085	2,282	1,058	19,506	0.403	11.97				

Australian Gold Production

The Queensland Mines Department reports the gold production of the State in January at 24,500 oz., or $506,415. Of this, 400 oz. was placer gold, the rest from quartz mines. Mount Morgan reported 5409 oz. of the total.

Victoria gold production in January was 40,848 oz., or $844,328 in value.

The production of Western Australia in January was 132,267 oz. fine gold, or $2,713,959. This output was 17,552 oz. less than in December, and 6893 oz. less than in January of last year.

The gold production of New South Wales in January was 19,885 oz. or $411,023. The mineral production of the State for the year 1908 is valued at £8,609,607. This includes £954,854 for gold; £2,947,824 for lead and silver; £502,812 for copper; £205,447 for tin; £3,353,093 for coal. The coal production was 9,147,025 tons.

Correction

In the article on the "Progress of Gold Mining in North Carolina," by E. W. Lyon, in the Journal of Feb. 6, 1909, the beginning of the third paragraph of the third column on page 296 should read: "The discharge ends of machines are set 8 in. and 4 in. higher, respectively, than the feed end."

Economics of Steel Prices

The announcement on Feb. 19 that "official price schedules" for steel products, rails excepted, had been abandoned—in other words, that competition now is to be free and that all producers will sell at such prices as they may see fit—was in some ways the most important and most truly historic event since the panic of 1907, remarked *The Evening Post.* That it marked the withdrawal from the publicly promulgated theory of 1908, that economic depression and paralysis of consuming power were no conclusive reasons for reducing prices, was itself a matter of great significance; because, if that theory had been vindicated, a good part of the time-honored principles of political economy would have had to be discarded. But the scope of the steel trade's action is wider than the steel trade; it has to do with the whole problem of consumption and prices in hard times.

Even the three-dollar concession of last June was granted unwillingly and under protest; it was alleged, by way of argument against it, that it would not elicit an additional dollar's worth of orders. But this, quite obviously, was an argument wholly from the producer's point of view. If every industry dominated by a great corporation had adopted the same principle and had been able to hold prices permanently, any consumer of merchandise can see what his position would have been.

There are two distinct views expressed, in both financial and industrial circles, over the recourse to an "open market" in the steel trade. One, and the most obvious, was that a dangerously unsettling condition of things had come about, that profits in a basic industry were presently to be slaughtered, and that no one could read the future. The other held that a wholly artificial and untenable situation had been abandoned with a view to readjusting conditions to a basis where makers and consumers might meet on equal terms, break the long deadlock by gradual resumption of activity, and build from the bottom up for the new and certain era of prosperity. Even if the breaking-down of the "stand-pat policy" on prices means a leap into the unknown, the continued maintenance of that policy would equally have meant a pause on the brink of the gulf, into which the trade was well aware it must sooner or later plunge.

The "open market" of 1900 was in reality a result of the Boer war panic; for our steel trade, during 1899, had been relying largely on the huge mass of export orders placed by the booming industry of Europe. The financial collapse in England and Germany, and the fall in foreign steel prices, forced a reduction in our own steel market; it was not until October, 1900, when steel prices had been cut from the exorbitant $41 per ton of October, 1901, to $17, that the market righted itself. The price was back at $22, on a greatly improved trade, before the ensuing spring; after that, the United States Steel Corporation took the field.

In other words, little more than half a year elapsed, after the panic of 1893, before the open market had brought producers and consumers together on a stable basis; in 1900, a full year had elapsed. In neither year was there present the conserving and restraining power of a dominant corporation in the trade; in both, the lower level fixed turned out to be a spur to American ingenuity and enterprise, which presently sent our steel manufacturers into a broader field, where we met and conquered the rest of the producing world.

Duty on Zinc Ores

SPECIAL CORRESPONDENCE

The Treasury Department has acquiesced in the decision of the court in the zinc ore case. It is now expected that the next move in the controversy will be the raising of a case in court to determine the meaning of the words "lead-bearing ores" in paragraph 181 of the Dingley act reading "lead-bearing ores of all kinds 1½c. per pound on the lead contained therein." This grows naturally out of the points settled in the case now accepted by the Government as closed. The Treasury Department makes its official announcement in a letter to the Collector of Customs at Corpus Christi, Texas, in which it says in part: "The Department is in receipt of a letter from the Attorney-General in which he states that no steps will be taken looking to a review of the decision of the United States Circuit Court of Appeals for the Fifth Circuit in suit No. 1961, United States *vs.* C. G. Brewster, involving the classification of zinc ore known as carbonate, silicate, and sulphide of zinc. The carbonates and sulphides were assessed with duty under paragraph 183 of the tariff act as crude, metallic, mineral substances, and the court affirmed the decision of the Board and Circuit Court that the carbonates are free of duty under paragraph 514 as calamine, and the sulphides are free of duty as minerals crude under paragraph 614. You are, therefore, hereby authorized to forward a certified statement for the refund of the duties collected in excess in this case. While the Circuit Court of Appeals affirms the decision of the Board and Circuit Court that the ores are free of duty, it sustained your assessment of duty under paragraph 181 upon the lead contents without regard to the percentage of lead contained therein and you are hereby instructed to assess duty upon the actual lead contents in future importations of such ores."

Economic Law Prevails

The meaning of the situation which was publicly recognized in the steel trade, today, is not at all mysterious, said *The Evening Post,* Feb. 19. Economic law has asserted itself, and the attempt, honestly but mistakenly entered upon last year, to prevent its operation through the power of aggregated capital, has broken down. That it was bound to do so eventually, on any other supposition except that the financial panic of 1907 was a mere teapot tempest, has been the belief of perhaps the majority of experienced business men. The mistake in last year's "stand-pat policy" on prices lay in its fundamental assumption that, since buying orders would not be instantaneously stimulated by a cut in prices during severe industrial depression, therefore no decline whatever in prices ought to be permitted. From such a position it was but one short step to the corollary which the Steel Corporation's chairman openly accepted, last April, that increased demand was not a deciding factor in higher, or increased supply in lower prices. The quite conclusive answer to that theory was, that it discarded entirely the function of great corporations as the regulators of prices—a perfectly normal office—and made them the absolute dictators. To hold the price of an industrial staple at the high level of prosperity, in the face of industrial depression and impaired consuming power, was every whit as unreasonable, from an economic point of view, as to have made a radical cut in prices at the hight of legitimate trade demand in 1906. The Steel Corporation wisely regulated trade that year by preventing a "runaway" advance in prices; it might have used, and still may use, its powers wisely in the existing situation to prevent an absolute slaughtering of values such as should throw industrial projects into chaos.

Recent investigation by the Government, through the Forest Service, as to the effect of bleeding pine trees of their resin has shown the following results: (1) that bled timber is as strong as unbled if of the same weight; (2) that the weight and shrinkage of the heartwood is not affected by bleeding; (3) that the durability of the heartwood is not affected by bleeding, since the resin comes from sapwood only. The investigation involved mechanical tests and the physical and chemical analyses of the wood of bled and unbled trees from the same locality.

The world's output of graphite is estimated by the Geological Survey of India to be in the neighborhood of 70,000 to 80,000 tons per annum. Of this about one-third comes from Ceylon. The Travancon state, of India, in 1906 produced about 2600 tons.

Rescue Apparatus

Mining men have recently busied themselves in studying the different types of rescue apparatus now on the market. Each manufacturer claims that his machine has all the virtues, while among the miners themselves, each rescue brigade at its respective station appears to have some favored form. Among the many machines now being used are the Draeger, Fleuss, Shamrock, Weg, and a liquid-air apparatus. A number of engineers are coming to favor the use of liquid air as an agency in rescue work, basing their preference for this machine on the fact that it provides a low, refreshing temperature to the air supplied to the wearer. Another point in favor of this apparatus is that it has only one valve (the outlet valve) which is an item of much importance, as valves are generally looked upon with suspicion. The chief argument advanced against this type of apparatus is the rapid evaporation that takes place, amounting in some instances to as much as 5 per cent. per day. One large coal company, however, has ordered a complete equipment of this type, and is now putting in a liquid-air plant of its own.

Many engineers object to the Draeger apparatus, because it uses a helmet, and the fact that the pressure gage is not accessible for inspection by the wearer of the apparatus. This gage is fixed behind, and another person must consult it for the wearer. Those who advocate the Draeger apparatus claim that the giddiness and faintness sometimes experienced, are not due to the head being boxed up in a helmet. They declare these symptoms are caused by poisoning from CO_2, there being at the time a preponderance of this gas in the breathing bag.

With regard to the gage being situated at the back of the wearer, this, of course, could be remedied at the cost of introducing a rubber-tube connection, which, however, would provide another source of weakness. Some of those who oppose the oxygen breathing apparatus claim that the men work at a greater rate than when a normal atmosphere is breathed. One authority in investigating this condition states that men breathing pure oxygen do not consume any more than they would if they were breathing atmospheric air. This same authority says that in breathing air containing from 9 to 63 per cent. of oxygen, there is no noticeable change in the sensations of the rescuer. It is only when the percentage of oxygen falls to 7 or 8 that a condition of numbness sets in. The human body is able to satisfy its needs of oxygen, provided that the inspired air contains from 10 per cent. the inspired air contains from 10 per cent. upward. It is difficult, therefore, to understand how increased energy can arise from breathing air containing an excess of oxygen.

Colliery Notes

In order to protect men at the shaft bottom, cage bonnets should be made high enough so that falling coal striking the bonnets will not be thrown into the entry.

On the continent, three-phase alternating current is often prefered to the continuous current in coal mines, on account of the danger supposed to lie in the commutator. Continuous-current motors generally spark at the brushes.

In inclined workings, tapered or sharpened props last much longer than those of uniform thickness. The former are also more economical, more efficient, and safer. Tapered props can also be taken out of the mine, re-tapered, and used in a thinner seam. Lastly, the tapered prop is more easily withdrawn.

The most favorable months of the year for cutting timber are December, January and February. During these months there is comparatively little sap in the trees. Timber cut when the sap is circulating through the tree decays rapidly. Seasoned timber will last fully one-quarter longer than green timber.

The efficiency of safety catches should be carefully tested at regular intervals. In making this test, the cage is generally raised above the top platform, and heavy timbers are laid across the head of the shaft to catch the cage, should the catches fail to work. The rope is then cut and the cage stopped by the catches.

The cost of electric power depends largely on the size of the plant. Centralization is the idea now being supported by good authorities. Statistics from England show that at a plant having an output of 2500 kw., the cost per kilowatt was $268. The total cost of this plant was $700,000. At another station having an output of 40,000 kw. and costing $5,800,000, the total cost per kilowatt was only $139.

When mules are used to gather cars at the face, the maximum distance the animal should haul is generally determined by the ability of the mule to haul the required quantity of coal to the parting as fast as it is hauled to the shaft bottom. This distance may vary from 600 to 2000 ft. In mule haulage, two drivers are preferable, since they can assist each other when cars are derailed. Except where the grades are steep, the drivers should follow each other rather than make alternate trips.

Where there are several landings in a shaft, great care should be taken in the arrangement of signals. A good plan is to safeguard against danger by providing for each landing a distinct bell that cannot be mistaken as belonging to any other level than the one with which it is connected. Strict rules should be enforced, prohibiting the movement of a cage from any landing before the engineer has received and responded to the signal given at that landing. When work is temporarily abandoned at any level, the safety gates should be locked or otherwise made secure.

In firing shots of high explosives, safety is obtained in proportion as the stemming is complete. One authority says that in ordinary shot-holes, he considers a safe proportion is a minimum of 9 in. of stemming to a charge of 3 oz. of high explosive, with a proportionate increase of stemming for larger charges. The knowledge that shots charged with a high explosive will blast the work required with little or no stemming, has caused a mistaken idea that the stemming of shot-holes is of only minor importance. Every experienced miner knows that shots fired without proper stemming emit a dangerous amount of flame, sufficient in most cases to ignite either firedamp or coal dust.

Every coal mine should have as a part of its equipment, a reliable barometer, so that careful readings of atmospheric conditions may be registered daily. An electric barometer has recently been invented, which depends for its operation upon the short-circuiting of a U-shaped carbon filament by means of a barometric mercury column. The filament dips into the top of the column, and as the atmospheric pressure increases the mercury rises in the tube, cutting down the length of the exposed part of the filament, and thus reducing the resistance. As the mercury is also affected by temperature, a second filament and mercury column is provided. In this latter column, the tube is sealed, so that the mercury will not be affected by atmospheric conditions.

Sixteen highly insulated, lead-covered, and armored cables, each carrying 100 e.h.p., will be much more expensive than four cables each carrying 400 e.h.p. Where all the current is required for a long-distance transmission, it is probable that for a great part of the distance all the current can go in large cables and at a reduction of perhaps 20 per cent. in the average cost per horsepower transmitted. If, for instance, we transmit our current two miles, with 400 volts at the motor, and a drop of 10 per cent. per mile from generator to motor, the cost of the cable for 100 e.h.p. will be approximately $12,000, and erection $2000. If these figures were multiplied by 16, we would have nearly $230,000 as the cost of the cables and of erection; however, if all the power were taken this distance in four large cables, each of 400 h.p., the cost of the cables would be reduced 20 per cent. In deciding a problem of this character, we have to reconcile two conflicting needs: First, the convenience and safety of low-tension motors; second, the economy of high-tension mains.

THE ENGINEERING AND MINING JOURNAL
Issued Weekly by the
Hill Publishing Company
JOHN A. HILL, Pres. and Treas. ROBERT MCKEAN, Sec'y.
505 Pearl St., New York.
London Office: 6 Bouverie Street, London, E. C., Eng.
CABLE ADDRESS "ENGMINJOUR, N. Y."

Subscription, payable in advance, $5.00 a year of 52 numbers, including postage in the United States, Mexico, Cuba, Porto Rico, Hawaii or the Philippines. $6.50 in Canada.

To foreign Countries, including postage, $8.00 or its equivalent, 33 shillings; 33 marks; or 40 francs.

Notice to discontinue should be written to the New York office in every instance.

Advertising copy should reach New York office by Thursday, a week before date of issue.

For sale by all newsdealers generally

Entered at New York Post Office as mail matter of the second class.

CIRCULATION STATEMENT

During 1908 *we printed and circulated* 507,500 *copies of* THE ENGINEERING AND MINING JOURNAL.

Our circulation for January, 1909, *was* 54,000 *copies.*

February 6	12,000
February 13	10,000
February 20	10,000
February 27	10,000

None sent free regularly, no back numbers. Figures are live, net circulation.

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The Cut in Steel Prices

In the JOURNAL of Feb. 6, we said: "In this country the Steel Corporation has been the leading exponent of the theory that reductions of prices were unwise and unnecessary. We have repeatedly argued against that fallacy, as have other journals. We understand that the directors of the Steel Corporation at last recognize among themselves that they were mistaken."

With that change of mind, it was, of course, only a question of time when a reversal of policy would be made. This was announced on Feb. 19, when radical cuts in the prices for steel products were made. This led to more or less demoralization in the stock market, where it is reckoned that the profits of the Steel Corporation will be seriously diminished. That does not necessarily follow. In the first place, there is likely to be a readjustment of wages, which matter is indeed taken care of in the cases of those companies which pay their men upon a sliding scale; in the second place, the cut will sooner or later stimulate business and enable the works to operate more nearly at full capacity, which will be more economical than the half scale or five-eighths scale of the last year and more; in the third place, it is apt to be more profitable to sell a lot of goods at a small profit than a small amount at a large profit, the latter being what the Steel Corporation has lately been doing.

If there be anything in economic theory —all recent experience, as well as all prior, proves that there is—the fallacious ideas of the managers of great aggregations of capital have been one of the most influential factors in retarding the return of prosperity, and consequently their retreat is one of the best things that could happen.

Mr. Carnegie remarked recently that it is a great mistake to try to hold up prices in time of panic. If he had been at the head of the Steel Corporation, he said, his policy would have been to reduce prices enormously, so that a man contemplating the erection of a skyscraper would say: "Here's a bargain. I will buy my steel and start work at once." This would be followed in other parts of the country and business would begin to pick up. We do not doubt that this will now come about—not right away, but much more quickly than otherwise was to be expected.

Chinese and Negro Labor in the Transvaal

The question of mine labor in the Transvaal having been finally decided by the legislature of that colony, which enacted a law requiring the deportation of the Chinese laborers as fast as their contract terms expired, the work of returning them to their own country has gone on steadily for over two years, without seriously interfering with the operation of the mines, notwithstanding the predictions made when the law was under discussion.

The total number of laborers reported in Transvaal mines—excluding white men—has been as follows for two years past, at half-yearly intervals:

	Kafirs.	Chinamen.	Total.
Jan. 1, 1907	83,567	53,828	137,395
July 1, 1907	89,593	51,441	141,034
Jan. 1, 1908	118,204	31,840	150,044
July 1, 1908	132,339	18,413	150,752
Jan. 1, 1909	148,722	12,283	161,005

In the two years there was an increase of 65,155 Kafirs, and a decrease of 41,545 Chinamen; a net gain of 23,610 laborers. This does not imply that the efficiency of the Kafir is less than that of the Chinaman. More laborers have been needed, owing to the extended operation of many mines, the increase in tonnage taken out owing to the working of lower-grade ore, and to the inclusion of some new mines. The handling of the lower-grade ore alone required a considerable increase in the working force in the mines and at the mills.

The larger force of natives has been obtained with little difficulty, owing to the concurrence of several causes. These were the discontinuance of railroad and other public works; the impoverishment of the natives over a considerable part of South Africa by the loss of cattle from plague; and the extension of recruiting operations for the mines over Portuguese and other territory heretofore untouched. A considerable number of negro laborers are now being brought to the Transvaal from the Zambesi country. These men are hardly the equal of the Kafirs in physical strength and in intelligence, and they require acclimation after their transition from their own hot, moist climate to the cooler region of the high veldt; but they are generally tractable and make good laborers when they become accustomed to the climate and the work.

The enactment of the deportation law

was the result of political rather than economical considerations, since the Chinese, as a rule, were fairly good mine laborers. The question has been heretofore fully discussed, so that it is sufficient to say here that the government seems to have been wise in its determination to eliminate the Asiatic element from the already mixed population of the Transvaal. It may be added that the importation of some 60,000 foreign laborers into the country within a few months, and their return to their native country in three years—for the last of them will probably go during the present year—with so little disturbance, constitutes one of the remarkable industrial movements of modern times.

The Revelation of a Metallurgical Secret

For many years, until a portion of it was destroyed by fire, the Argo works (near Denver, Colo.) under Dr. Richard Pearce, was one of the most instructive metallurgical plants of the world. Its rather exceptional processes were always an object of interest to visitors in Denver, to whom the works were thrown open, and they were described in important papers in the *Transactions* of the Institute. However, there was one department of the works to which visitors were never admitted, and of which no description was ever published. This was the department in which the gold-copper bottoms were refined. Doctor Pearce remarked in his presidential address before the Institute in 1889, "The treatment of this alloy and the separation of the gold from the copper is a part of the process which, for certain business considerations, I am not at liberty to describe." Many efforts were made by rival and curious metallurgists to discover this secret, but always without success.

The gold and silver refinery of the plant was destroyed by fire in 1906. In view of the development of modern practice in the refining of copper matte, etc., the management decided that it would be inadvisable to rebuild that part of the works. In a paper by Harold V. Pearce, in the *Bulletin* of the Institute for February, 1909, he says: "This decision probably removes altogether from the sphere of practice the Pearce method for the separation of gold. At all events, it removes the business reasons which have prevented hitherto the publication of the principles involved. At the suggestion of Doctor Raymond, secretary of the Institute, my father, Richard Pearce, the former manager of these works, has requested me to prepare a brief description of this process for the benefit of our members."

In the first place, it is interesting to chronicle how the process was evolved. In the early days of smelting at Black Hawk, the gold-copper bottoms were shipped to Boston for refining. This led to many annoying features of business. Doctor Pearce inaugurated a series of experiments, unknown to Professor Hill, to prove whether an idea that had occurred to him had any merit. Having satisfied himself by producing a lump of gold weighing 2 or 3 lb., and having explained to Professor Hill how it was done, the latter immediately ordered the Boston works to be closed after finishing the stock of material on hand, inasmuch as future refining was to be done at Black Hawk. The new process solved the whole problem, each metal being put into marketable form; the gold in bars ranging upward from 900 fine; silver in bars 999 fine, and copper as bluestone. During the 30 years that this process was used, 1,532,905 oz. of gold were extracted by it from 54,549 tons of copper.

Now for the secret disclosed by Mr. Pearce. If the gold-copper alloy in the form of copper bottoms be granulated and melted with a suitable quantity of pyrite, there results a matte and a copper-bottom, the latter carrying the bulk of the gold present in the original alloy. The iron sulphide acts upon the copper, producing a compound of copper with iron and sulphur, corresponding closely to the mineral bornite both in appearance and composition. The second bottom, being melted, refined, and again granulated, is once more melted with pyrite, a further quantity of copper combining with it to form matte, and a smaller amount remaining as metallic copper, still carrying the major portion of the gold. The process is, therefore, a series of refining with granulations and subsequent treatments, or "strippings," with pyrite, with the result that the whole of the copper is finally extracted or "stripped" from the gold. A certain quantity of gold passes into the matte at each stripping, but any attempt to remove too large a proportion of the copper in one operation results in too much gold being taken up by the matte. The process is described in detail in the paper by Mr. Pearce, from which we have been quoting.

In conclusion, Mr. Pearce remarked that "the process was never materially changed from the time it was first placed in operation in Black Hawk until the works were destroyed by fire. It is quite possible that the simplicity of the method of separation accounts for the fact that it was not developed before." Perhaps also it is the reason why the nature of the process was not surmised by outsiders; it is always the simple and obvious to which eyes are shut. However, it is certainly remarkable that this secret was preserved so completely for the long period of its use.

Carroll D. Wright

The death of Carroll D. Wright removes a public servant who for many years was content to do his work faithfully and with understanding without seeking for special reward; and this course brought him into the prominence which he had not sought. Few men understood the true value and uses of statistics better than he; and few had studied labor questions in their various phases more thoroughly and carefully. Perhaps the service which brought him most into general public notice was on the Anthracite Strike Commission of 1902-3. The shaping of the work of that commission was largely due to Colonel Wright's advice; and to him and to Judge Gray was due the organization of the conciliation board, which proved such a valuable part of the commission's settlement.

Colonel Wright was an indefatigable worker, and not even the incurable disease which shadowed the closing year of his life could keep him from doing what he could to forward his chosen work.

THE SECRETARY OF a Comstock Mining Company, who is now a fugitive, appears to have developed the art of milking suckers to the highest point yet reached in the history of 50 years of nefarious transactions in connection with the Comstock lode. This brilliant gentleman issued 22,500 shares of fictitious stock of the Belcher Silver Mining Company, sold it, put the money in his own pocket, levied assessments on the fictitious stock along with the real stock, and appropriated those proceeds.

Spelter Statistics for 1908

By W. R. Ingalls

For the sake of promptness I am publishing the statistics of production without waiting for those pertaining to consumption, the collection of which is more laborious.

The production of spelter in 1908 is given in Table I, which is based on reports from all of the smelters.

I. PRODUCTION OF SPELTER.

(In Tons of 2,000 Lb.)

State.	1907.	1908.
Colorado	5,200	3,079
Illinois	56,103	50,244
Kansas	133,561	99,136
Missouri	11,594	10,196
Oklahoma	5,094	14,867
South and East	38,060	32,989
Total	249,612	210,511

There was no addition to smelting capacity in 1908, excluding the new plant at Danville, Ill., and the two new works at Bartlesville, Okla., which went into operation just before the end of 1907 and were completed early in 1908. Otherwise no smelter added so much as a furnace. So far as I am aware no plans for new plants were prepared during the year.

All of the smelters but three reported the stock of spelter at their works on Dec. 31, including that held for speculators. The total of their reports is 19,848 tons. This is a little less than was previously reported to me as of Dec. 15. Allowing for the companies that did not report I estimate the stock in first hands on Dec. 31 to have been 25,000 tons. The delivery into consumption is computed in Table II.

II. DELIVERIES FOR CONSUMPTION.

(In Tons of 2,000 Lb.)

	1907.	1908.
Stock January 1	4,550	32,883
Production	249,612	210,511
Imports	1,778	881
Total supply	255,940	244,275
Exports	563	2,640
Stock, December 31	32,883	25,000
Deliveries	222,494	216,635

In considering the figures in Table II it is important to make a distinction between "deliveries" and "consumption." The zinc industry joins hands with iron and copper, which are represented by the galvanizers on one hand and the brass-makers on the other. The consumption of iron and copper in 1908 was not more than 70 per cent. of that in 1907. It is unreasonable to suppose that the consumption of spelter did not fall off more than 5 per cent. Discussion of this subject must be deferred until the reports from the smelters of dross and other secondary material are in hand, together with the reports from the consumers.

Production of Zinc Ore

Every smelter in the United States reported his receipts of ore, enumerated according to State and country of origin. The totals are given in Table III.

III. PRODUCTION OF ZINC ORE IN THE UNITED STATES.

(In Tons of 2,000 Lb.)

State.	1907. Tons.	1908. Tons.
Arizona	285	879
Arkansas	4,088	2,582
Colorado	(a) 142,510	(b) 82,852
Idaho	11,847	1,558
Kentucky	1,005	341
Missouri-Kansas	297,126	273,420
Montana	1,218	2,783
Nevada	4,593	1,445
New Mexico	4,281	2,290
New Jersey	368,710	(c)
Oklahoma	3,250	9,300
Tennessee	1,071	566
Utah	9,043	709
Wisconsin	53,011	58,135
Others	885	85
Totals	902,923	.....
British Columbia	1,157	6,157
Mexico	108,800	66,383
Grand totals	1,012,880	.....

(a) Includes receipts of ore for making zinc-lead pigment at Cañon City, Colo. (b) Does not include receipts of ore for making zinc-lead pigment at Cañon City, Colo. (c) Not given, because it would practically disclose the business of a single company.

Determination of Gold in Copper Bullion

By Fred F. Hunt*

The amount of work necessary in the "all-fire" method for the determination of gold in copper bullion has lead to investigation for shorter methods for this purpose. Experience has shown that with only concentrated sulphuric acid too much sulphide of copper was formed to allow of good cupellation with only one scorification. To overcome this, mercuric sulphate has been used, but owing to the formation of globules of mercury and their possible loss, with a resultant loss in gold, this method has not been generally employed.

In dissolving the borings with sulphuric acid there seems to be more sulphides formed at the beginning of the action than later. This suggested the use of cupric sulphate with sulphuric acid and I found that this combination left such a small amount of sulphides that the usual scorification with 35 grams of test lead gave a button that was readily cupeled.

The following details are observed: To 80 c.c. of concentrated sulphuric acid add 25 c.c. of a solution of cupric sulphate (160 grams per 1000 c.c.), using a low, wide No. 5 beaker. Heat this mixture to such a temperature that on the addition of the borings action commences immediately; add 1 a.t. borings, spreading them over the bottom of the beaker, heat until all dissolving action has ceased (from 1 to 1½ hours), cool, add about 400 c.c. water, stirring to prevent caking of the crystals, bring just to a boil, filter and wash the beaker thoroughly, using a rubber-tipped glass rod as "scrubber." Place filter paper with precipitate in a 2½-in. scorifier, dry and burn off the paper, add about 35 grams test lead and 1 gram ground silica, scorify to button of about 9 grams, cupel and part as usual.

Silver may also be determined by this method by adding to the filtrate from the gold enough solution of permanganate of potash to produce a permanent color, then 1 drop of saturated salt solution and 10 c.c. of a 10-per cent. solution of acetate of lead; stir well and let stand over night, filter with the usual precautions, add paper and precipitate to the same scorifier with the gold and proceed as in the case of gold only.

*Chemist, 77 Pine street, New York.

"Blue Gas," a New Illuminant Used in Germany

By Robert Grimshaw*

In Germany there is being introduced a new system of illumination based on the same principles as that for railway-car lighting. This illuminant is called "blue gas." The gas is delivered in liquid form, in such shape that it may be used in closed rooms in hanging burners giving from 50 to 1000 c.p. To use the gas all that is necessary is to pour the liquid from the steel cylinders, in which it is delivered, into the gasometer. This is almost as convenient as having one's own gas plant, for one can protect himself against accidents at the factory or delays in transit by always having on hand several filled cylinders. A cylinder contains 22 lb. of the gas, and costs 12 marks, or about $2.86. This quantity will supply a 50-c.p. burner for 480 hours, so that this illuminant appears to be cheaper than petroleum. This "blue gas" can, of course, be used for heating and cooking as well as for forging, hardening and tempering, and other industrial processes. It is a hydrocarbon compound, free from carbon monoxide, and is not poisonous; its heating effect is 15,000 units against 4500 of ordinary coal gas. The gas is burned at a pressure of about an inch of mercury, or 13.6 in. of water at the burner. Almost any apparatus that is arranged to burn ordinary coal gas or acetylene gas can be altered without much difficulty to burn this; and in such cases all that is necessary is to make the connection between the cylinder and the house pipes through a reducing valve.

As regards its explosibility, Professor Götz of Augsburg reports that, while the range of explosibility of acetylene gas when mixed with air is between 2 and 49 per cent. (a range of 47 per cent.), and that of ordinary coal gas is between 6⅓ and 19⅓ per cent. (a range of 13 per cent.), that of "blue gas" is only between 4 and 8 per cent. (a range of 4 per cent.). No special permission from the authorities or the insurance companies is necessary for its use.

*Mechanical engineer, Dresden, Germany.

The International Conservation Conference

SPECIAL CORRESPONDENCE

The meeting of the International Conference called by President Roosevelt, began in Washington on Feb. 18, with a reception by the President for the Canadian and Mexican commissioners at 10 o'clock in the East room of the White House. Later the conferees proceeded to the Diplomatic room of the State department for regular sessions. The remainder of the morning was taken up with formal addresses of welcome and responses of the visitors. In the afternoon the conference began its work in earnest.

The delegations from Canada and Mexico include men known as experts in the natural resources of their countries. Canada is represented by Hon. Sydney Fisher, minister of agriculture of the Dominion; Hon. Clifford Sifton, ex-minister of the Interior, under whose administration many of the regulations concerning the use of Canada's resources were adopted, and Dr. Henri S. Beland, a member of the Canadian parliament, a well known authority on these subjects. The Canadian delegation is accompanied by Robert E. Young, land expert in the Canadian Department of the Interior, who acts as its secretary.

To represent Mexico, President Diaz sent Romulo Escobar, Manuel A. De Quevedo and Carlos Sollerier. Señor Escobar, who heads the delegation, is one of the foremost authorities in Mexico on the agriculture of the country. He has been at different times minister of the Department of Agriculture and of the Department of Forestry. With his brother he edits the farm paper *El Agricultor Mexicano,* and he presented a paper on "Agriculture in Mexico" at the time of the St. Louis exposition. Señor De Quevedo is the present minister of forestry. The conference is open to members of the Cabinet, and is shared in by all members of the National Conservation Commission.

The foreign delegates have prepared outlines of the conservation movement in their own countries. Early last year the whole of the public timberlands in British Columbia, except what has been leased, was placed in forest reserves. This action was taken to check waste by bringing the care and cutting of timber resources more effectually under government control. The action affected 150,000,000 acres—as much land as was put into all national forests of this country up to 1907. In the Yukon all water-power rights are now granted for only 20 years, and at the expiration of that time their control reverts to the public. President Diaz, of Mexico, is already applying the principles of forestry, and understands fully the benefits to be gained. He is also interested in the improvement of agricultural methods. Mexico has few large waterways, but has provided for the expenditure of several million dollars for the improvement of internal navigation.

Reports received here concerning recent discussion in the Canadian parliament of President Roosevelt's proposal for coöperation for the conservation of the natural resources of the whole continent indicate that the support of the conservation movement in the Dominion will be nonpartisan. R. L. Borden, leader of the opposition, was as enthusiastic in his support as Sir Wilfrid Laurier, the premier, who expressed his deepest approval of the movement.

Canada has sent to the National Conservation Commission a number of carefully prepared maps which show the present status of the public lands of the Dominion, as well as the distribution of the principal natural resources and the development of its transportation systems. The Canadian authorities have also gathered together and sent to the chairman of the commission a comprehensive collection of government documents bearing on the natural resources of the country. These have been carefully indexed and bound according to subjects for use at the conference.

The first meeting of the committee on coöperation recently appointed by the chairman of the Conservation Commission to block out methods of joint work on the part of the States and of the United States will be held in Washington for the purpose of determining upon some concerted action. No program has as yet been decided upon.

Gifford Pinchot, Chairman of the National Conservation Commission, was chosen chairman of the International Conservation Conference at the first regular session of the conference which met in Washington Feb. 18. In attendance the conference was limited to the commissioners from the three countries participating. A few members of the National Conservation Commission were present in an advisory capacity.

Secretary of State Bacon called the afternoon session to order. Mr. Sydney Fisher, the Canadian Minister of Agriculture, and chairman of the Canadian delegation, placed Mr. Pinchot in nomination, and Mr. Romulo Escobar, chairman of the Mexican Commission, seconded the nomination. No other name was proposed.

At the suggestion of the chairman of the Canadian delegation, the conference agreed to begin its deliberations by hearing statements from the commissioners of the respective countries as to the extent, condition, and regulations governing the resources of those nations. The first subject taken up was Forests, the first statement on which was made by Miguel A. de Quevedo, President of the Mexican Forestry Commission, who is one of the Mexican commissioners. Mr. Quevedo spoke in French. This was followed by a statement of forest conditions in the United States by Mr. Pinchot. The statement as to Canadian forests was made on the following morning by Commissioner Fisher. Other speakers followed with special papers.

The striking feature of the conference has been the effort to give it a world-wide scope. Anticipating the interest which would naturally be aroused in other countries by the present North American Conference, President Roosevelt believed that it could be made the precursor of a world congress on the same subject. By an *aide-memoire* in January last, the principal governments were informally sounded to ascertain whether they would look with favor upon an invitation to send delegates to such a conference. The responses have so far been uniformly favorable, and the Conference at Washington has suggested to the President that a general conference be called by him. The President feels, therefore, that it is timely to initiate the suggested world conference for the conservation of natural resources, by a formal invitation.

It is intended to have the conference consider a general plan for an inventory of the natural resources of the world and devise a uniform scheme for the expression of the results of such inventory to the end that there may be a general understanding and appreciation of the world's supply of the material elements which underlie the development of civilization. The conference will also probably consider the general phases of the correlated problem of checking and when possible, repairing, the injuries caused by the waste and destruction of natural resources and utilities, and make recommendations in the interest of their conservation, development, and replenishment.

With such a world-inventory and such recommendation, the various producing countries of the whole world would it is believed be in a better position to cooperate, in the safeguarding and betterment of their common means of support. As was said by the President in the preliminary *aide memoire,* "the people of the whole world are interested in the natural resources of the whole world, benefited by their conservation, and injured by their destruction. The people of every country are interested in the supply of food and of material for the manufacture in every other country, not only because these are interchangeable through processes of trade but because a knowledge of the total supply is necessary to the intelligent treatment of each nation's share of the supply."

Capital expenditure, according to Hugh F. Marriott, should include only the cost of the property and the cost of equipment. If more ground is acquired or additional equipment installed so as to increase the output, then these should be added to the capital-expenditure account.

Views, Suggestions and Experiences of Readers

Comments on Questions Arising in Technical Practice and Debatable Points Suggested by Articles in the Journal

CORRESPONDENCE AND DISCUSSION

Superheated Steam for Winding Engines

The statement in "Colliery Notes", in the JOURNAL for Oct. 24, 1908, to the effect that at a large English colliery by using superheated steam the number of winds had been increased from 60 to 70 per hour, giving an increased output of 400 tons per day, is of great interest and importance. When it was first introduced superheating was not always successful, and even now is not always successful. As in so many other cases, some engineers who adopted superheating, in the early days of its introduction, omitted to consider one important factor, the temperature of the steam with which they had to deal.

REASON FOR USING SUPERHEATED STEAM

Superheating was introduced to overcome the losses arising from cylinder condensation, and the winding engine affords probably one of the extreme cases. Assume that the steam enters the cylinder at a pressure of 120 lb. per sq.in. and at 350 deg. F., and is cut off, say, at half-stroke. Assume also, for simplicity, that the steam issues from the exhaust at atmospheric pressure, or at a temperature of 212 deg. F. The cylinder walls closely follow the changes of temperature in the steam, and a good deal besides happens in consequence. The winding engine stands, for a certain time, after each wind, and during that period, the engine is cooling and fairly quickly, too, by conduction, radiation, and convection. So that before the commencement of the next wind, the temperature of the cylinder will probably be several degrees below that of the exhaust steam. It may quite easily, in certain cases, be as low as 150 deg. F. The entering steam, at the commencement of the next wind being at a temperature of 350 deg. F., finds itself in the presence of a large mass of metal at, say, a temperature 200 deg. F., or lower. The large mass of metal comprising the engine cylinder is in metallic, and, therefore, thermal-conductive, connection with the large mass of the winding drum and with the rope, which also carries off some heat. As a result, the steam which enters the cylinder at the commencement of the first stroke is cooled very considerably, and the steam which enters the cylinder at each of the working strokes after the first few is also cooled to a certain extent, although not so much as that which enters at the commencement of the wind.

And now comes in another important, though rather a complicated, series of phenomena. We are accustomed to the three states of matter, the solid, the liquid, and the gaseous, but there is also a fourth condition into which many substances may enter, viz., that of vapor. Steam is a gas, and behaves as a gas. Water vapor is not a gas, and does not behave as a gas. Gases have the property of carrying a certain quantity of the vapors of certain substances. Steam, therefore, has a capacity for absorbing the vapor of water, the capacity increasing with the temperature. In the operation of the steam boiler a certain amount of water vapor is formed, and this is carried along by the steam. There is also a certain mechanical action going on in the steam boiler that results in the formation of minute globules of water; these are also carried over with the steam and add to the trouble. Consequently, the steam which enters the cylinders carries with it a certain quantity of the vapor.

The saturation curve for steam with vapor is steep between 200 and 350 deg. F.; so a large portion of the vapor is deposited upon the comparatively cold surface of the cylinder walls. Later on, this vapor which has been deposited, and which has become liquid, is reconverted, not to vapor, but to steam. In order that it may become steam, however, it must absorb heat from somewhere, and the only source is the steam which remains in the cylinder. This means that the steam, which has probably, by this time, commenced the expansive portion of the stroke, is cooled to a greater extent than simple expansion would cause. And as temperature and pressure go together with all gases, cooling the steam means lowering its pressure, and this means the lowering of the mean pressure against the piston.

BENEFITS OF USING SUPERHEATED STEAM

I believe that it has not been possible in winding engines to use a very high expansion, but in all engines expansion is carried on to as great an extent as possible. The pressure of the steam is falling from the moment the entry valve is closed, and, therefore, the mean pressure is always less than the boiler pressure. Assuming a cut-off at half-stroke, the mean pressure behind the piston would be about 115 lb. per sq.in., and with a cut-off at one-third the stroke, about 94 lb. per sq.in. The temperature of steam at 115 lb. per sq.in. is 347 deg. F., and at 95 lb., 334 deg. F. Assume, for the sake of calculation, that the mean temperature of the steam throughout the stroke is reduced 20 deg. F. With a cut-off at one-third the stroke, the mean pressure would be reduced to about 65 lb. per sq.in., or approximately a loss of 30 per cent. in the power obtained from the engine. With greater expansion the loss would be greater.

The benefit of superheating is that it converts the vapor which comes over with the steam, and also any water that may be held in mechanical suspension, into steam, and any superheater or system of superheating, is efficient, exactly in the proportion that it accomplishes this. While steam which carries water vapor with it deposits that vapor upon the comparatively cold surfaces of the cylinder walls, superheated or "dried" steam is merely cooled to a certain extent and loses a certain amount of its pressure, and if the superheating is great enough the steam does not condense. Therefore, with properly superheated steam entering the cylinder, considerably more work should be done because, as there is no condensed steam to reabsorb heat at a later period of the stroke, there is less loss of heat energy.

One caution, perhaps, is necessary. Engineers sometimes imagine that applying superheat, in any way and to any extent, will cure the evils of cylinder condensation. Superheating is only effective, and economy only results when the vapor carried by the steam is completely converted into steam.

SYDNEY F. WALKER.

Bath, England, Dec. 29, 1908.

Windy Shots in Coal Mines

The most common cause of coal-mine explosions is usually attributed to blown-out or windy shots which have been tamped with fine coal or dust by a careless miner; as a matter of fact, no miner with a minimum of intelligence, ever thinks of tamping his hole with fine coal or dust without first thoroughly wetting it, for he knows very well that dry coal or dust as tampng would not adhere or pack around his needle sufficiently tight to allow the squib unrestricted passage to the cartridge.

I am aware that in many places the indiscriminate use of a blasting barrel is permitted, which practice cannot be too severely condemned, because it engenders gross carelessness in tamping the hole, this fact often furnishing the means of

a blownout shot. When a needle is used, conditions are different, because the miner must be careful in tamping his hole lest the same become clogged in withdrawing the needle thus preventing his squib from igniting the powder; in this latter case, the miner knows that he may have to drill out his hole and try it again.

Fine coal or dust that has been thoroughly moistened and used for tamping, never was and never will be the means of conveying a flame beyond the mouth of the hole. We sprinkle the mine to keep down the dust, the object being to prevent it from circulating with the air, and to render it less liable to ignition from any cause; the purpose is accomplished when the dust has been sprinkled thoroughly. The miner wets his fine coal for tamping, not with a view of preventing it from flaming, but because he knows that it would be worthless to him as tamping in a dry condition.

An Unusual Experience

That shots are an important factor in coal-mine explosions is too evident to be slighted even for a moment, but that the miner is invariably at fault is placing the blame where it does not always belong. In corrobation of this fact I will relate the following experience I had while managing a coal mine for a well-known Western company: The third level of this mine had advanced about 3000 ft. from the slope, and two practical miners were working in the entry face. One day they fired a shot as usual and immediately afterward repaired to the face to load the coal it broke down; the shot was an ordinary one, having just enough powder to do the work required. A few moments after the shot had been fired and while the drivers and other laborers were gathered on the entry near the slope, a gust of wind having the force of a cyclone hurled them in all directions, extinguished their lights and filled the place with dust from the roof and sides until they were almost suffocated, producing consternation in their minds and causing them to believe their hour of doom had come.

Two gas-watchmen were in the level above and having distinctly heard and felt the shock, at once concluded that an explosion had occurred somewhere in the mine. They hastened to the third level and an investigation was immediately begun to ascertain what damage, if any, had been done, and to discover if possible the cause of this unusual disturbance.

Here were all the characteristics of an explosion, save that there was no flame; the miners in the rooms along the entry had the same experience as the drivers and laborers, all had felt and heard the shock, which extinguished their lights and threw them to the floor. We learned that none of the miners had fired recently and all declared that the wind had come from the direction of the entry face. Accordingly we went on to the entry face and found the two miners there busily engaged loading their coal into a car. We questioned them closely and examined the effects of the shot carefully and saw no reason why such a commotion should result from a commonplace shot such as this one proved to be. The only solution we could arrive at was that the shot in question had in some manner created an air wave which had traveled against a strong current until it reached the slope where its force was spent in the larger area of the mine.

Had there been standing gas anywhere along the entry or in the rooms, an explosion must have occurred the moment it was carried by this wave in contact with an open light. This phenomenon, if such it might be called, occurred many times afterward, always from the entry, and always having the same characteristics, the entry miners at no time noticing anything unusual at the time the shot was fired.

A Practical Suggestion

A burglar, it is said, sometimes spreads a blanket over a safe before he blows or cracks it, his idea being to deaden the noise made by the explosion as much as possible; if he has the correct idea, then why should we not carry this idea into our coal mines, and hang a heavy curtain or door near the entry face the same to be tightly closed just before a shot is fired. The recent disaster at Marianna is said to have originated from a windy shot in the face of one of the Blanche entries; had a curtain or a door been suspended between the last crosscut and the entry face I venture to assert that the shot in question would not have occasioned any serious trouble.

My experience has been that a windy shot is liable to occur at any time regardless of what kind of tamping is used, and since they are bound to happen, we should endeavor to devise some means to prevent them from spreading the least possible distance from their source.

D. G. Thomas, Supt.
Evanston Coal Company.
Evanston, Wyoming.

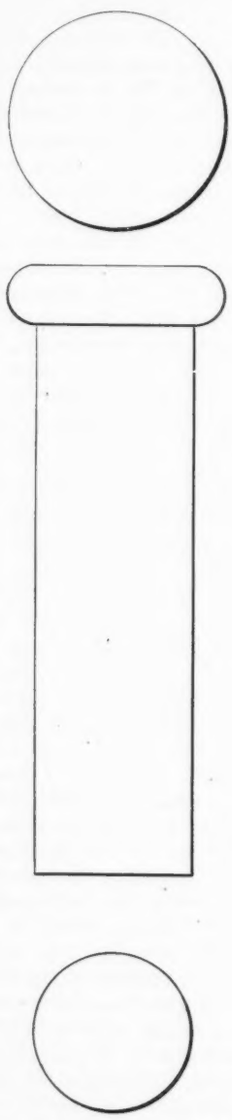
Jan. 25, 1909.

The Gordon Drill

Recently I have learned that the makers of both the Murphy and Waugh drills, who are using "vanadium steel" for the hammers in the drills, have found that it is not necessary to drill the centers out of the hammer, as vanadium steel can be made to take the desired temper *all the way through*. No other steel will do this.

The few of us who know of the breaking of the drills, which I mentioned in previous correspondence, are greatly puzzled over the peculiar action of the steel. I have thought that there might be such a thing as a "critical point" in the fatigue of steel; that is, if the weight and number of blows were increased or decreased slightly the steel, in this instance in the shape of drills, would "stand."

While the shapes of the hammers vary somewhat in the different makes of hammer drills, the accompanying sketch shows about the average type of hammer when vanadium steel is used.



AVERAGE TYPE OF HAMMER IN WHICH VANADIUM STEEL IS EMPLOYED

W.

Denver, Colo., Jan. 31, 1909.

According to the report of the Secretary for Mines the tin ore raised in Tasmania for the quarter ending Sept. 30, 1908, was 1187 tons, valued at £111,094, against 1095 tons, valued at £101,626, for the quarter ending June 30, 1908.

Questions and Answers

Inquiries for information are answered in this department as promptly as possible, but more or less delay is often unavoidable. Many inquiries involve a good deal of investigation and these can be answered only when the general interest in the subject is conceived to justify the expenditure of the time required. Correspondents should refrain from asking for advice that ought to be obtained by professional consultation with an engineer. We will not answer questions pertaining to the value of specific mining enterprises. Inquiries should be framed concisely.

Placers

What valuable metals other than gold are found in placers?

R. S.

Chiefly tin and platinum. Metallic copper is found in certain placers in Alaska.

Monazite

What is the value of monazite sand?

R. S.

This varies according to the percentage of thorium, which ranges from five to seven in the ordinary commercial sand. The American production in 1907 was valued at 12c. per lb.

Shorthand by Machinery

What is the address of the maker of the machine for taking shorthand notes that was described in the JOURNAL of July 11, 1908? F. H.

Address, The Stenotyper Shorthand Machine Company, 105 New Bond street, London, W.

Meerschaum in the United States

Is any meerschaum mined in the United States? Who are buyers of the mineral?

O. F. R.

So far as we are aware no meerschaum has been produced in the United States. The Meerschaum Company of America, 25 Broad street, New York, is reported to own a deposit in the Alunogen district, Grant county, N. M. Dana reports the occurrence of meerschaum in Utah and at Webster, N. C. The purchasers of meerschaum are the manufacturers of smoking pipes. William Demuth & Co., 507 Broadway, New York, is an important concern.

Value of Allanite

What is the market value of allanite? Who buys it?

C. McW.

The value of allanite depends upon the content of thorium oxide, which is very variable; so much so, that the mineral is not commonly regarded as a source of thoria. Sufficient cerium oxide is obtained as a by-product from monazite sand to prevent allanite from becoming a source of that oxide. The Welsbach Incandescent Lighting Company, Gloucester, N. J., would probably be interested in examining samples of allanite.

Hydrometallurgical Extraction of Copper

Are there any plants in successful operation recovering copper directly from its ore by roasting, lixiviation and precipitation? If so, please give a brief description of the plant, quality of ore treated, and results obtained.

A. B. W.

Such a process, with electrolytic precipitation, employed in Poland, was described in a recent number of the JOURNAL. The Henderson process for burned pyrites is in constant use at Natrona, Penn. See *The Mineral Industry*, Vols. VIII and IX.

Weighing Gold and Silver

In the buying and selling of fine gold and silver on the large scale, what difference is permitted, commercially, between the weights of the buyer and the seller, arising from small discrepancies between the scales used by each one and the variation arising from differences in latitude and altitude? What differences is it customary to accept in the marketing of the precious metals at New York?

F. R.

The weights of the buyer are always taken, though the shipper has a right to be represented, and in case he is not satisfied with the weights rendered he may arrange for a referee who will weigh them on scales mutually accepted and this result be final. In selling silver in London less than ¼ oz. is disregarded; for instance, should the scale weight show 1000.37 the return would be 1000.25 oz. If the weight were 1000.15 the weight reported would be 1000 ounces.

Meerschaum

What is meerschaum, where is it found, and what are its uses?

A. G. M.

Meerschaum, or sepiolite, is the hydrated silicate of magnesium, containing varying amounts of water and frequently having some of the magnesium replaced by the oxides of iron, copper or nickel. H = 2 to 2.5; sp. gr. = 2 [Dana].

It is found in Greece and Asiatic Turkey; in the United States deposits have been discovered in Utah, North Carolina and New Mexico. The Utah and North Carolina deposits are said to be idle, but the Meerschaum Company of America, 25 Broad street, New York, is working the deposit in Grant county, New Mexico.

The meerschaum is found admixed with calcite and other impurities, and these are removed by dry concentration. The finely divided meerschaum is then pressed into blocks or other forms at a temperature of 1080 deg. C., and under certain secret conditions.

The largest use for meerschaum is in the manufacture of smoking pipes. The New Mexico variety is also used to make poker chips, toilet articles, and backs of mirrors.

Gayley Dry Blast

Will you name the blast-furnace plants at which the Gayley dry blast has been installed? W. F. C.

The following companies have installed the Gayley dry blast. The first figure given represents the number of furnaces equipped, and the second the year started: United States Steel Corporation, Isabella furnaces, Etna, Penn., 2, 1904; South Chicago Furnaces, South Chicago, Ill., 3, 1908; Warwick Iron and Steel Company, Pottstown, Penn., 2, 1906; E. G. Brooke Iron Company, Birdsboro, Penn., 1, 1906; Guest, Keen & Nettlefolds, Ltd., Cardiff, Wales, 2, 1907; total furnaces in operation, 10.

The following have plants under construction: Toledo Furnace Company, Toledo, O., 2 furnaces; N. W. Iron Company, Mayville, Wis., 2; Pioneer Iron Company, Marquette, Mich., 2; Thyssen, Deutscher Kaiser Works, Germany, 2 (also Bessemer plant); total under construction, 7.

Additional licenses have been sold to the following: Youngstown Sheet and Tube Company, Youngstown, O., 2 furnaces; Federal Furnace Company, Chicago, Ill., 2; Brier Hill Iron and Coal Company, Youngstown, O., 1; Hamilton Iron and Steel Company, Hamilton, Ont., 2; total additional licenses, 7. This gives a total of 24 furnaces equipped, in course of equipment, and licensed.

Floated Barytes

Please give me some information regarding the grinding and floating of barytes. What is the best machinery to use for reducing the mineral to an impalpable powder? A. L. F.

There are two methods in use for the preparation of barytes for the market. The first method involves crushing the mineral to from ¼ to ⅜ in. size, bleaching, drying, and then reducing to an impalpable powder in bur mills. The other method involves preliminary crushing in a rock breaker, reduction to an impalpable powder in bur mills or tube mills, bleaching and drying. In the second process the mineral is usually crushed wet, and when the final product is classified by floating, it is referred to as "floated" barytes.

The essential machinery for producing floated barytes includes crusher, tube mill, bleaching tank of wood or vitrified brick, classification tank, and dryer for the bleached and floated material. Bur mills may be substituted for tube mills, but in this case the crusher should be followed by rolls.

The operation of drying the floated material often presents many difficulties. As far as we know, rotary dryers give about as good results as any other kind. This part of the work must be carried on carefully, for the bleached mineral is liable to become discolored; the cause of the trouble is often hard to determine. Details of the methods used at different plants are not easy to secure, as most works operate behind closed gates.

Regarding the makers of the machinery required, reference should be made to the advertising pages of the JOURNAL.

Patents Relating To Mining and Metallurgy

A Selected and Classified List of New Inventions Described during the Past Month in the Publications of the Patent Offices

UNITED STATES AND BRITISH PATENTS

A copy of the specifications of any of these patents issued by the United States Patent Office will be mailed by THE ENGINEERING AND MINING JOURNAL upon the receipt of 25 cents. British patents are supplied at 40 cents. In ordering specifications, correspondents are requested to give the number, name of inventor and date of issue.

ALUMINUM

ALUMINUM SILICATE—Method of Treating Aluminum Silicate. Frank J. Tone, Niagara Falls, N. Y., assignor to the Carborundum Company, Niagara Falls, N. Y., a Corporation of Pennsylvania. (U. S. No. 906,-173; Dec. 8, 1908.)

SOLDERING—Improvements in Soldering Aluminum. Thomas Harden. Fulham, and Amalgaline, Limited, London. (Brit. No. 26,932 of 1907.)

SOLDERING — Improvements in the Method of Soldering Aluminum. Albert Nielson, Nedre Strandgade, Bragernoes, Drammen, Norway. (Brit. No. 5055 of 1908.)

WELDING—Improvements in Welding or Melting Objects of Aluminum. Max U. Schoop, Garenne-Colombes, France. (Brit. No. 24,283 of 1907.)

BORAX

PROCESS OF MAKING BORAX. Gilbert E. Bailey, Los Angeles, Cal., assigner of one-half to Archie Stevenson, Los Angeles, Cal. (U. S. No. 911,695; Feb. 9, 1909.)

CHROMIUM

PRODUCTION FROM FERRO CHROMIUM—Process for the Production of Pure Chromium from Commercial Ferro-Chromium. Emilien A. O. Viel, Paris. (Brit. No. 24,875 of 1907.)

COAL AND COKE

BRIQUETTING—Method of Briquetting Carbonaceous Materials. Walter T. Griffin, Limoges, France; James Eddy Blake, Isabelle S. Graves, and Charles H. Clarke, executors of said Walter T. Griffin, deceased. (U. S. No. 905,693; Dec. 1, 1908.)

COAL CUTTING—Improvement in, or Relating to Machinery for Cutting Coal. Hubert V. Neukirch and Ernst E. Freytag, Zwickau, Germany. (Brit. No. 10,946 of 1908.)

COAL-CUTTING MACHINES — Improvements in Mechanism for Driving Coal-Cutting Machines. Anderson, Boyes & Company, Ltd., Motherwell, Scotland. (Brit. No. 19,110 of 1908.)

COKE—An Improvement in Coke Quenching Apparatus. Aktiengesellschaft für Kohlendestillation, Gelsenkirchen-Bulmke, Germany. (Brit. No. 18,110 of 1908.)

COKE-DRAWING APPARATUS. Charles M. Clarke, Pittsburg, Penn. (U. S. No. 907,681; Dec. 22, 1908.)

COKE OVENS—Door for Coke Ovens or Furnaces. John Whitaker, Newhaven, Penn. (U. S. No. 912,218; Feb. 9, 1909.)

COKE OVENS—Horizontally-Moving Leveling-Rod for Horizontal Furnaces. Heinrich Koppers, Essen-on-the-Ruhr, Germany. (U. S. No. 907,818; Dec. 29, 1908.)

COKE OVENS—Improvements in, and Relating to Coke Ovens. Victor E. F. Fieschi, Doual, France. (Brit. No. 28,049 of 1907.)

COKE OVENS—Improvements in and Relating to Coke Ovens for the Recovery of By-products. Theodor von Bauer, Berlin. (Brit. No. 28,290 of 1907.)

CONVEYING—Improvements in, and Relating to Appliances for Carrying Coal or Other Minerals from the Headings, Rooms, Walls or Excavating Tunnels of Mines to the Hutches. Thomas P. Neilson, Coatbridge, Scotland. (Brit. No. 3193 of 1908.)

RESPIRATION APPARATUS for Use in Coal-Mines and Other Places. William E. Garforth, Normanton, England. (U. S. No. 911,389; Feb. 2, 1909.)

COPPER

ELECTROLYTIC REFINING—Process for the Electrolytical Refining of Copper. Joseph Awalow, St. Petersburg, Russia. (Brit. No. 26,829 of 1907.)

PYRITIC ORE TREATMENT—Improvements in Treating Pyritic Copper and Nickel Ores. James T. Carrick and Basil S. Pattison, Johannesburg, Transvaal. (Brit. No. 2971 of 1908.)

PYRITIC SMELTING. James T. Carrick, Johannesburg, Transvaal, assignor of one-half to Basil Stuart Pattison, Johannesburg, Transvaal. (U. S. No. 912,540; Feb. 16, 1909.)

GOLD AND SILVER

AMALGAMATOR. William F. Bedell, North Yakima, Wash. (U. S. No. 907,443; Dec. 22, 1908.)

AMMONIA-CYANIDE PROCESS of Treating Ores Containing Precious Metals. David Mosher, San Francisco, Cal., assignor to Ammonia Cyanide Engineering Company, San Francisco, Cal., a Corporation of California. (U. S. No. 911,254; Feb. 2, 1909.)

CYANIDE PROCESS—Improvements Connected with the Recovery of Gold by the Cyanide Process, and with other Chemical Processes Wherein Zinc is Employed. Edward H. Strange, Charles A. Pim and Francis E. Matthews, London. (Brit. No. 7211 of 1908.)

ELECTROMAGNETIC STAMP-BATTERY. James P. Lynn, Trafalgar, Kalgoorlie, Western Australia, Australia. (U. S. No. 910,-834; Jan. 26, 1909.)

IRON AND STEEL

ALLOYS—Improvements in the Manufacture of Steel Alloys. Jack R. Crawford, Pasadena, Cal. (Brit. No. 21,356 of 1907.)

BASIC BESSEMER PROCESS—An Improvement in the Basic Bessemer Process. Louis P. J. A. H. Messier, Lille, France (Brit. No. 8168 of 1908.)

BLAST-FURNACE. Joseph E. Johnson, Long Dale, Va. (U. S. No. 906,717; December 15, 1908.)

BLAST-FURNACE CASTING APPARATUS. Michael Killeen, Braddock, Penn. (U. S. No. 912,688; Feb. 16, 1909.)

BLAST-FURNACE GASES — Centrifugal Apparatus for the Purification of Blast Furnace, Generator and Other Gases. Communicated from the Société Anonyme John Cockerill, Seraing, Belgium. (Brit. No. 13,563 of 1908.)

BLAST-FURNACE PRACTICE—Method of Effecting the Precipitation of Flue-Dust in Blast-Furnaces and of Preventing the Formation of the Same. Ralph W. H. Atcherson and William Siddall, Bellaire, Ohio. (U. S. No. 912,641; Feb. 16, 1909.)

CASTING PIPE—Mode of Casting Soil, Water and Gas Pipe Direct from the Blast-Furnace in Permanent Molds. Edgar A. Custer, Philadelphia, Penn. (U. S. No. 904,-759; November 24, 1908.)

CASTING PLANT. William J. Patterson, Springdale, Penn., and Albrecht B. Neumann, Chicago, Ill. (U. S. No. 912,406; Feb. 16, 1909.)

CHARGING BLAST-FURNACES—Improvements in and Relating to Charging Apparatus for Blast Furnaces and the Like. Allgemeine Elektricitats Gesellschaft, Berlin. (Brit. No. 4969 of 1908.)

CUPOLA CAR-DUMPING MECHANISM. James Hyslop, Harvey, Ill., assignor to Whiting Foundry Equipment Company, Harvey, Ill., a Corporation of Illinois. (U. S. No. 911,725; Feb. 9, 1909.)

INGOT-STRIPPER. Henry Aiken, Pittsburg, Penn. (U. S. No. 905,827; Dec. 8, 1908.)

MANUFACTURE—An Improved Process for Manufacturing Steel From Chromiferous Pig Iron. Frank D. Carney, Steelton, Penn. (Brit. No. 16,093 of 1908.)

MANUFACTURE—Process of Manufacturing Iron and Steel. Carleton Ellis, White Plains, N. Y. (U. S. No. 911,870; Feb. 9, 1909.)

ORE TREATMENT—Process of Treating Iron Ore. Charles B. Morgan, Cal. (U. S. No. 910,707; Jan. 26, 1909.)

RECEIVER FOR MOLTEN METAL. Harry H. Campbell, Steelton, Penn. (U. S. No. 907,680; Dec. 22, 1908.)

REDUCTION PROCESS—Process of Reducing Ores. George L. Fogler, Pittsburg, Penn., assignor to Fogler Heat and Reduction Company, Tacoma, Wash., a Corporation of Washington. (U. S. No. 908,234; Dec. 29, 1909.)

ROLLING-MILLS—Roll for Rolling-Mills. Evan Williams, New Castle, Penn. (U. S. No. 907,930; Dec. 29, 1908.)

TUYERE for Blast-Furnaces and Converters. Cyrus Robinson, Mount Vernon, N. Y. (U. S. No. 911,614; Feb. 6, 1909.)

MAGNESIUM

CASTING—Preparing Magnesium and Alloys Thereof for Casting. Paul Rakowicz, Griesheim-on-the-Main, Germany, assignor to Chemische Fabrik Griesheim Electron, Frankfort-on-the-Main, Germany. (U. S. No. 906,-820; Dec. 15, 1908.)

RARE METALS

THORIUM—Art of Treating Ores. Robert McKnight, Pittsburg, Penn. (U. S. No. 912,-485; Feb. 16, 1909.)

TITANIUM ALLOYS—Process of Making Titanium Alloys. Frederick M. Becket, Niagara Falls, N. Y., assignor to Electro Metallurgical Company, New York, N. Y., a Corporation of West Virginia. (U. S. No. 910,-894; Jan. 26, 1909.)

TIN

DETINNING—Apparatus for Detinning Tin-Scrap. Meredith Leitch, Elizabeth, N. J., assignor by mesne assignments, to Metal Process Company, a Corporation of New York. (U. S. No. 906,726; Dec. 15, 1908.)

DETINNING—Improvements in, or Relating to Apparatus for Removing Tin from Tin Plate Waste. Dr. Neinrich Brandenberg, Kempen-on-Rhine, Germany. (Brit. No. 2322 of 1908.)

ZINC

EXTRACTION PROCESS—Improvements Relating to the Extraction of Zinc from Ores by the Precipitation Process. Antoine H. Imbert, Grand-Montrouge, Seine, France. (Brit. No. 13,492 of 1908.)

SEPARATION—Improvements in the Separation of Zinc from Its Ores and Compounds. Woldemar Hommel and Henry L. Sulman, London. (Brit. No. 23,901 of 1907.)

MINING—GENERAL

BORING—A Method of Consolidating Water Bearing Sands in the Sinking of Bore Holes. Compagnie des Mines de Béthune, Pas de Calais, France. (Brit. No. 28,541 of 1907.)

EXCAVATING AND LOADING MACHINE. Josephus Bingaman, Garnett, Kan., assignor of one-half to George W. Hunley, Garnett, Kan. (U. S. No. 909,928; Jan. 19, 1909.)

EXCAVATING SHAFTS, ETC.—Process for Excavating Shafts, Tunnels and the Like. Friedrich Koepe, Bochum, Germany. (Brit. No. 20,788 of 1908.)

MINING METHOD—Method of Mining. William G. Anderson, Smuggler, Colo. (U. S. No. 906,765; Dec. 15, 1908.)

PROPS—Improvements in Mining Props. John H. Eickershoff, Düsseldorf, Germany. (Brit. No. 22,223 of 1908.)

SIGNALING—Improvements in Signaling Systems for Mines and the Like. George T. Plumb, Johannesburg, Transvaal. (Brit. No. 10,104 of 1908.)

TIMBERING—Improved Method of Walling, Timbering and Propping Mines. Friedrich Nellen, Essen on the Ruhr, Germany. (Brit. No. 14,273 of 1908.)

VENTILATING SYSTEM for Mines. John Quin, Houtzdale, Penn. (U. S. No. 911,525; Feb. 2, 1909.)

ORE DRESSING

AGITATOR. David H. Sherman, Los Angeles, Cal. (U. S. No. 912,628; Feb. 16, 1909.)

CLASSIFIER. Charles W. Merrill, Lead, S. D. (U. S. No. 907,387; Dec. 22, 1908.)

CONCENTRATION—Apparatus for Concentrating Ores. Walter M. Sanders, Marion, Ky. (U. S. No. 911,077; Feb. 2, 1909.)

CONCENTRATION—Improvements in Ore Concentrating and Separating Apparatus, Francis and Henri Dallemagne, Pasages, Spain. (Brit. No. 11,684 of 1908.)

CONCENTRATING-TABLE. Willis G. Dodd, San Francisco, Cal. (U. S. No. 908,758; Jan. 5, 1909.)

CONCENTRATORS—Actuating Mechanism for Concentrators. William L. Card and Frank S. Card, Denver, Colo., assignors to the Card Manufacturing Company, Denver, Colo., a Corporation of Colorado. (U. S. No. 907,736; Dec. 29, 1908.)

DISINTEGRATING APPARATUS—Apparatus for Disintegrating Ores and Other Materials. Harry W. Harding, New York, N. Y. (U. S. No. 908,861; Jan. 5, 1909.)

ELECTROMAGNETIC ORE-SEPARATOR. Thomas Charlton, Chicago, Ill., assignor of one-fifth to Robert L. Dorbandt and one-fifth to James H. Parker, El Paso, Tex. (U. S. No. 912,363; Feb. 16, 1909.)

FLOTATION PROCESS—Apparatus for Separating Ores by Flotation. Auguste J. F. de Bavay, Kew, Victoria, Australia. (U. S. No. 912,783; Feb. 16, 1909.)

GRINDING—Improvements in Grinding Machines for Minerals and Other Substances. Lawrence S. Burt, London. (Brit. No. 8955 of 1908.)

GRINDING MILLS—Improvements in Grinding Mills. Joseph Barr, Allentown, and William J. Montz, Ormrod, Penn. (Brit. No. 14,398 of 1908.)

MAGNETIC SEPARATION—Improvements in, and Relating to Magnetic Separating Machines. The Rapid Magneting Machine Company, Ltd., Herbert H. Thompson and Alfred E. Davies, Birmingham, Eng. (Brit. No. 2203 of 1908.)

ORE-CONCENTRATOR. Ulysses S. James, Newark, N. J., assignor, by direct and mesne assignments, to James Ore Concentrator Company, a Corporation of New Jersey. (U. S. No. 906,433; Dec. 8, 1908.)

ORE-FEEDER. Thomas M. Topp, San Francisco, Cal. (U. S. No. 910,097; Jan. 19, 1909.)

ORE-GRINDING MACHINE. George A. Denny, London, England. (U. S. No. 909,286; Jan. 12, 1909.)

ORE SEPARATION—Improvements in Ore Separating Processes. Marcus Ruthenburg, Lockport, N. Y. (Brit. No. 28,191 of 1907.)

ORE SEPARATORS — Improvements in Centrifugal Ore Separators. Philip F. Peck, Chicago, Ill. (Brit. No. 3683 of 1908.)

ORE-TREATING MACHINE. John W. R. Laxton, Lynn, Mass. (U. S. No. 909,429; Jan. 12, 1909.)

SCREEN—Oscillating Screen for Ore and Other Materials. Albion B. Colcord, Kokomo, Colo., assignor to Robert B. McConney and Charles L. Buckingham, Denver, Colo. (U. S. No. 911,113; Feb. 2, 1909.)

SCREEN—Rotary Screen for Ores and Other Materials. Howard G. King, Denver, Colo. (U. S. No. 905,325; Dec. 1, 1908.)

SEPARATION—Improved Apparatus for Separating Metals and the Like from Extraneous Matter. Richard M. Simpson, Wellington, N. Z. (Brit. No. 16,663 of 1908.)

SEPARATION PROCESS—Improvements in Apparatus for More or Less Completely Separating Subdivided Solid Matter from a Liquid. Particularly Applicable for Thickening Ore Pulp and for Feeding or Measuring the Pulp or Solid. Francis E. Elmore and Alexander F. Elmore, London. (Brit. No. 26,821 of 1907.)

STAMP MILLING—Improvements in Ore Feeders for Stamp Mills and the Like. Arthur H. P. Fitzpatrick, Chester, Eng. (Brit. No. 14,585 of 1908.)

METALLURGY—GENERAL

ALLOY of Iron and Nickel with Vanadium Carbide. Walter Rübel, Hamburg, Germany. (U. S. No. 906,937; Dec. 15, 1908.)

ORE ROASTING—Method of Roasting Ores. Henry K. Hess, Philadelphia, Penn. (U. S. No. 912,568; Feb. 16, 1909.)

SMELTING—Improvements in the Metallurgic Treatment or Smelting of Ores and Other Materials. Kristian Birkeland, Christiania, Norway. (Brit. No. 913 of 1908.)

MINING MACHINERY AND APPARATUS

BORE HOLES—Device for Ascertaining the Deviation of Bore Holes. Louis Gerhardt Nordhausen, Germany. (Brit. No. 11,628 of 1908.)

BORE HOLES—Improvements in, or Relating to Device for Determining the Deviations of Bore Holes from the Vertical. Karl Haussmann, Aix-la-Chapelle, Prussia. (Brit. No. 3068 of 1908.)

CANDLESTICK—Miner's Safety-Candlestick. Frederick Muenger, Hill City, S. D., assignor of one-half to Camillo von Woehrmann, Hill City, S. D. (U. S. No. 906,449; Dec. 8, 1908.)

CENTRIFUGAL PUMPS — Improvements in, or Relating to Centrifugal Pumps. James T. Hossiter, London. (Brit. No. 21,584 of 1908.)

CONVEYER-BELT SUPPORT. Edwin E. Vrooman, Hyattsville, Md., assignor, by direct and mesne assignments, of one-half to John J. Ridgway, Chicago, Ill., and one-half to Edward G. Thomas, Brookline, Mass. (U. S. No. 909,833; Jan. 12, 1909.)

CRUSHING MACHINES—Improvements in Machines for Crushing Stone and Other Hard Substance. Saxon Engineering Company, Ltd., Saxon Iron and Steel Works and Edward G. P. Bousfield, Fenton, Eng. (Brit. No. 25,536 of 1907.)

DREDGE—Suction-Dredge or the Like. Franklin H. Jackson, Berkeley, Cal., assignor to Byron Jackson Iron Works, West Berkeley, Cal., a Corporation of California. (U. S. No. 906,234; Dec. 8, 1908.)

DREDGES — Suction-Mounthpiece for Dredges. Horace J. Clark, Chicago, Ill., assignor to Clark Dredge Manufacturing Company, Chicago, Ill., a Corporation of Maine. (U. S. No. 909,062; Jan. 5, 1909.)

DRILL-HOLE-CLEANING ATTACHMENT for Hammer-Drills. Daniel S. Waugh, Denver, Colo., assignor to the Denver Rock Drill and Machinery Company, Denver, Colo. (U. S. No. 907,430; Dec. 22, 1908.)

DRILLING—Core-Drilling Apparatus. Coleman A. Terry, New York, N. Y. (U. S. No. 904,161; November 17, 1908.)

DRILLS—Improvements Relating to Hammer Drills. George H. Rayner, Sheffield, and Cecil Walton, Moresby, Whitehaven, Eng. (Brit. No. 27,371 of 1907.)

DRILLS—Improvements Relating to Miners' Drills. The Hardy Patent Pick Company, Ltd., Heeley, and Mark Wainwright, Sheffield, Eng. (Brit. No. 10,503 of 1908.)

DYNAMITE-HEATER. Alexander H. Vannauker, Hazleton, Penn. (U. S. No. 911,463; Feb. 2, 1909.)

MINE-CAR PEDESTAL. John R. Roberts, Wilkes-Barre, Penn. (U. S. No. 905,000; November 24, 1908.)

MINERS' CANDLESTICK. Benjamin F. Kelly, Salt Lake City, Utah. (U. S. No. 910,390; Jan. 19, 1909.)

MINERS' CANDLESTICKS—Attachment for Miners' Candlesticks. Sanford M. Thurman, Los Angeles, Cal. (U. S. No. 908,821; Jan. 5, 1909.)

MINERS' DRINKING CANS — Improvements in, or Relating to Miners' Drinking Cans. Marks Garelick, Cardiff, Wales. (Brit. No. 9252 of 1908.)

MINERS' SAFETY-LAMP. Ernest A. Hailwood, Morley, England. (U. S. No. 908,765; Jan. 5, 1909.)

PICKS—Improvements in Miners' and Like Picks. Arthur Roughley, Syennymoor, Eng. (Brit. No. 2772 of 1908.)

ROCK-DRILL. John H. Huhn, Fairmont, W. Va., assignor of one-half to John R. Steel, Barrackville, W. Va. (U. S. No. 904,436; November 17, 1908.)

ROCK-DRILLING MACHINES—Improvements in Rock-Drilling Machines. Henry Ball, John Ball and Robert Airth, Knights, Transvaal. (Brit. No. 9064 of 1908.)

ROCK-DRILLING TOOL. Hugh G. Williams, Granville, N. Y., assignor of one-half to Samuel F. Culbertson, Baltimore, Md. (U. S. No. 912,925; Feb. 16, 1909.)

ROCK DRILLS—An Improved Chuck for Rock Drills. Jabez H. H. Bunt, Penzance, Eng. (Brit. No. 25,002 of 1907.)

ROCK DRILLS—An Improved Valve for Rock Drills and Analogous Reciprocating Appliances. George H. Rayner, Nether Edge, Sheffield, Eng. (Brit. No. 20,989 of 1908.)

SAFETY APPARATUS for Mine-Railways. Norval W. Dickerson, Derwent, Ohio. (U. S. No. 911,298; Feb. 2, 1909.)

SAFETY-LAMP. Nickolas B. Ippolito, Pittsburg, Penn. (U. S. Nos. 909,415 and 909,416; Jan. 12, 1909.)

SAFETY LAMPS—Igniting Device for Miners' Safety-Lamps. Ferdinand A. Wicke, Barmen, and Rudolf Gartenmeister, Elberfeld, Germany. (U. S. No. 908,432; Dec. 29, 1908.)

SAFETY LAMPS—Improvements in Apparatus for Igniting Miners' Safety Lamps. Ernest A. Hailwood, Morley, Eng. (Brit. No. 25,596 of 1908.)

SAFETY LAMPS—Improvements in Apparatus for Igniting Miners' Safety Lamps, Especially Suitable for Use in the Underground Workings of Mines and in the Like Places. Ernest A. Hailwood, Morley, Eng. (Brit. No. 27,140 of 1907 and 24,414 of 1908.)

STEAM DRILLING—Steam-Motor for Operating Tools in Drilling-Rigs. Frank S. Barkelew, Los Angeles, Cal., assignor to the California Steam Drilling Rig Company. (U. S. No. 12,904; Reissue, Dec. 29, 1908.)

TUNNELING-MACHINE. Charles A. Case, New York, N. Y., assignor to Case Tunnel and Engineering Company, New York, N. Y., a Corporation of Arizona. (U. S. No. 910,500; Jan. 26, 1909.)

TUNNELING MACHINES — Improvements in Rotary Tunneling Machines. Russel B. Sigafoos, Denver, Colo. (Brit. No. 6916 of 1908.)

METALLURGICAL MACHINERY AND APPARATUS

ELECTRIC FURNACES—Improvements in, and Relating to Electric Furnaces. Communicated from the General Electric Company, Schenectady, N. Y. (Brit. No. 23,071 of 1908.)

ELECTRIC FURNACES—Improvements in, and Relating to Electric Furnaces. Antoine H. Imbert, Grand Montrouge, Seine, France. (Brit. No. 17,281 of 1908.)

ELECTRIC FURNACES—Improvements in, or Relating to Electric Furnaces. Charles A. Keller, Paris, France. (Brit. No. 21,741 of 1908.)

ELECTRIC FURNACES — Improvements in, or Relating to Electric Furnaces. Hans Nathsius and Westdeutsche Thomasphosphatwerke Gesellschaft, Berlin. (Brit. No. 7923 of 1908.)

FURNACE—Universal Ore-Treating Furnace. Chauncey C. Medbery, New York, N. Y. (U. S. No. 912,394; Feb. 16, 1909.)

FURNACE - CHARGING MECHANISM. David Baker, Philadelphia, Penn. (U. S. No. 909,049; Jan. 5, 1909.)

FURNACE GRATES—Improvements in, and Relating to Furnace Grates. Heinrich Untiedt, Cassel, Germany. (Brit. No. 23,350 of 1907.)

FURNACE GRATES—Improvements in Furnace Fire Grates. Albert Jones and the Trimsaran Company, Ltd., Trimsaran, Kidwelly, South Wales. (Brit. No. 23,208 of 1907.)

HOIST FOR FURNACES—Bottom-Door Hoist for Furnaces of Cupolas. James Hysiop, Harvey, Ill., assignor to Whiting Foundry Equipment Company, Harvey, Ill., a Corporation of Illinois. (U. S. No. 911,726; Feb. 9, 1909.)

HYDROMETALLURGICAL APPARATUS—Mobile Hydrometallurgical Apparatus. Hiram W. Blaisdell and Joseph R. Brown, Los Angeles, Cal., assignors to Blaisdell Company, Los Angeles, Cal., a Corporation of California. (U. S. No. 907,309; Dec. 22, 1908.)

MOLD—Water-Cooled Mold for Receiving Supermolten Metal from an Electric Furnace. George O. Seward, Holcombs Rock, Va., assignor to Virginia Laboratory Company, New York, N. Y., a Corporation of New York. (U. S. No. 905,373; Dec. 1, 1908.)

ORE TREATMENT—Improvements in, or Relating to the Treatment of Ores for the Extraction of Metals Therefrom. Hugues Rosalt, Paris. (Brit. No. 25,357 of 1907.)

PRECIPITATING APPARATUS. John E. Greenawalt, Denver, Colo. (U. S. No. 906,011; Dec. 8, 1908.)

REDUCTION-FURNACE. Charles Van Brunt, Schenectady, N. Y., assignor to General Electric Company, a Corporation of New York. (U. S. No. 903,922; November 17, 1908.)

RETORT-FURNACES — Improvements in or Relating to Retort Furnaces and the Like. Hans Ries, Munich, Germany. (Brit. No. 8370 of 1908.)

ROTARY KILN. Manfred G. Semper, Weferlingen, Germany. (U. S. No. 909,464; Jan. 12, 1909.)

SMELTING-FURNACE Heated with Oil and Having Two or More Chambers Acting Alternately as Smelting or Preliminary Heating Chambers. (August Hock, Hanover-List, Germany. (Brit. No. 17,687 of 1907.)

SMELTING FURNACES—Improvements in, and Relating to Smelting Furnaces. Herbert F. Höveler, Merton Abbey, Eng. (Brit. No. 23,997 of 1907.)

TAP-SPOUT for Smelting-Furnaces. Frederick D. Gross, Denver, Colo., assignor of one-half to Colorado Iron Works Company, Denver, Colo. (U. S. N. 910,371; Jan. 19, 1909.)

Personals

Mining and metallurgical engineers are invited to keep THE ENGINEERING AND MINING JOURNAL informed of their movements and appointments.

There is a vacancy on the editorial staff of the JOURNAL open to a young mining engineer, who should have had some literary experience. Candidates are requested to call in person.

S. W. Mudd has returned to Los Angeles, California.

Wm. C. Ralston, of San Francisco, has been a visitor in New York.

S. F. Shaw, of Pasadena, Cal., is examining mines in Cochise county, Arizona.

J. W. Bryant, of Victoria, B. C., one of the Tyee Copper Company's mining engineers, is in Mexico.

Dr. William B. Phillips, of Birmingham, Ala., is examining iron-ore properties in Llano county, Texas.

E. B. Stahlknecht has established an office as consulting mining engineer at Torreon, Coahuila, Mexico.

John T. Fuller, Little Rock, Ark., has been appointed general manager of the Arkansas Diamond Company.

H. C. Hoover has returned from California and will shortly begin his course of lectures at Columbia University, New York.

Mortimer B. Fuller has been elected president of the International Salt Company, to succeed his father, the late E. L. Fuller.

George Stilwell, superintendent of the Hewitt mine, Silverton, Slocan district, B. C., has gone to England for two months.

Charles Briggs, president of the Calumet & Arizona Copper Company, of Bisbee, Arizona, is seriously ill at his home in Calumet, Michigan.

George M. Bloomer, manager of the Alamos Mines Corporation, Alamos, Sonora, Mexico, is in New York on business connected with the mines.

G. Harold Grant will shortly leave Victoria, B. C., on a professional visit to Japan. He may also go to Korea before returning to British Columbia.

Henry M. Adkinson has returned to Denver from a three weeks' trip of inspection to the properties under his management at Telluride. Colorado.

T. F. Cole, president of the Oliver Iron Mining Company, has been chosen to represent Minnesota on the reception committee to serve at the coming inauguration of President-elect Taft.

Frank Van Orden, superintendent of the Wyandot Copper Company in the Lake Superior district, has returned to the property after an extended visit to the Globe district in Arizona.

Allan Edyvean, formerly superintendent of the Arcadian stamp mill, has been appointed to take charge of the erection of the new Winona-King Phillip stamp mill in the Lake Superior copper district.

Edward G. Acheson, president of the International Acheson Graphite Company, of Niagara Falls, N. Y., has had the degree of doctor of science conferred upon him by the Western University of Pennsylvania, of Pittsburg.

H. H. Dyer, for five years past, superintendent of mines of the Shannon Copper Company, at Metcalf, Ariz., has resigned that position, to take effect March 1, and will open an office at Los Angeles, Cal., as consulting mining engineer.

Obituary

Edward Myers, formerly in charge of the Combination Fraction, at Goldfield, and recently operating a mine in the Gold Crater district, shot himself at Goldfield, Nev., Feb. 19, dying in a very short time.

J. H. Blanchard, a prominent mining engineer and operator, of Goldfield, Nev., died suddenly Feb. 11. At the time of his demise, Mr. Blanchard was operating the Combined Mining and Leasing Company, and the Grizzly Bear lease on the Consolidated ground.

John D. Bailey, who died in Pittsburg, Jan. 17, was born in that city in 1826. He was for a number of years connected with the Wayne Iron Works, and had charge at one time of the manufacture of the plates used on the ironclad vessels built for river service during the Civil war. Later he was prominent as an oil operator, and for some time was superintendent of the Chartiers Valley Gas Company. For many years past he had been a member of the Pittsburg Oil Exchange.

Carroll D. Wright died in Worcester, Mass., Feb. 20. Born in New Hampshire in 1840, he received a fair education in local schools. After serving with credit through the Civil war he began the practice of the law in Boston and also served two terms in the State Senate. In 1873 he was appointed chief of the Massachusetts Bureau of Statistics of Labor, and his intelligent and careful work in that position soon attracted attention. Before long his reports on labor questions were accepted as high authority. When the United States Bureau of Labor was established in 1885, Colonel Wright was appointed the first commissioner, and he held the position until 1905, a period of 20 years, during which his work was maintained at the same high standard which had marked it in Massachusetts. At different times he was called on to deliver special courses of lectures at Harvard University, at Oxford University, at Berlin, Heidelberg and elsewhere. He was also at different times president of the American Statistical Association and the American Association for the Advancement of Science. He was a member of many foreign societies. In 1902-3 he served as a member of the Anthracite Strike Commission, and his influence and advice did much toward securing the settlement reached by the commission. In 1905 Colonel Wright resigned his position as commissioner of labor, and was chosen president of Clark University at Worcester, Mass., but failing health prevented him from taking as active a part in that position as he might otherwise have done. His literary work is found mainly in his yearly reports.

Societies and Technical Schools

Canadian Mining Institute—The preliminary program for the annual meeting at Montreal provides for three sessions on each day of the meeting. On Wednesday, March 3, the morning session will be the business meeting, at which the reports of the officers and council will be presented. The afternoon and evening sessions will be devoted to reading and discussion of papers. On Thursday, March 4, the morning session will be devoted to the reading of papers. In the afternoon there will be one executive session to consider proposed amendments to the by-laws and in the evening a smoking concert.

On Friday, March 5, the morning session will be devoted to papers and discussions; the afternoon to any unfinished business which may remain. In the evening the meeting will close with the annual dinner.

College of the City of New York—Prof. Charles Baskerville, director of the Department of Chemistry, which has excellent laboratory and other facilities, gives notice that a special course in physical chemistry is offered to properly qualified persons. The course which is given by Dr. Leo Frank Guttmann, instructor in physical chemistry, involves 15 lectures Wednesday afternoons, accompanied by laboratory practice on Thursdays. The lectures, which begin Feb. 24, will cover the following topics: Introductory and Theoretical Foundations; Changes of State and the Kinetic Theory; Thermal Chemistry; the Phase Rule; Relation between Physical Properties and Chemical Constitution; Solutions and Osmotic Pressure; Atoms and Radioactivity; Faraday's Law and Electrolytic Transport; Influence of Mass and Temperature on the Progress of Reactions; Applications of Dissociation Theory; Electromotive Force. The laboratory work includes experimental verification of the above principles. The only expense attached is the actual cost of chemicals used and breakage.

Special Correspondence from Mining Centers

News of the Industry Reported by Special Representatives at San Francisco, Goldfield, Salt Lake City, Denver, London and Paris

REVIEWS OF IMPORTANT EVENTS

San Francisco

Feb. 17—The gold-dredging men have taken a leaf out of the hydraulic miner's book by adopting the use of water under pressure through nozzles to break down cemented banks into the dredge buckets and have greatly expedited their work thereby. Indeed, they are now increasing the size of the giants. They at first used 4-in. giants, but are now adopting 6-in. ones. By the use of three-step centrifugal pumps they get about 160 ft. head of water for use against the cemented banks. Two streams are kept playing, one on each side of the digging end of the bucket ladder, and these are moved as the ladder and line of buckets move, so as to play close to the buckets in the banks. The plan is quite effective where the gravel is at all cemented. And now some of the hydraulic miners of Trinity county are going to adopt a dredge to assist their operations. The higher banks will be piped as usual, and, as a supplementary appliance, a dredge will be installed to work the low benches of the hydraulic property. This is quite a concession to the cheapness of dredge work, for hydraulic mining has usually been considered the cheapest method of gaining gold. However, late work of large and heavy dredges is showing a very low cost, especially when the machines are new and repairs not necessary.

E. O. Miller, of Visalia, has brought suit against the Edison Electric Company, of Los Angeles, for damages to his mining claim in the upper Kern river cañon, by the erection of the electric company's big dam. Senator Miller's Hard Rock claim embraces the entire channel of the river and a strip on each side. The dam erected below the claim flooded it to such a depth that mining for gold is no longer possible. Hence the suit.

Attention is again being called to the deposits of chrome iron in Humboldt and Del Norte counties. One large deposit in the latter county was worked years ago and shipments made through Crescent City, but the expense of transportation was found to be too high for profitable working, and nothing has been done for the past 10 years. The deposits are owned by Philadelphia people. There are known to be several good sized deposits in the neighborhood of Bear river and in the Horse mountain copper district, near Willow creek, in Humboldt county. The Bear river deposit appears to be now coming into notice owing to the nearness of the new shipping point established at the mouth of the Mattole river.

State Senator Caminetti, who, when in Congress was the author of the act establishing the California Débris Commission, has a bill in the legislature which has been reported favorably, in relation to caring for hydraulic mining débris. The bill calls for the appointment of a consulting board of five members to the department of engineering who shall devise plans for preventing débris from mining or other causes from encroaching on navigable streams or the lands adjacent thereto; to select sites for settling reservoirs and storage of débris; to inspect hydraulic mines and pass upon their methods of storing débris; to determine the effect of hydraulic mining carried on by or under permission of the California Débris Commission; to construct restraining barriers and dams and other works as may be authorized by law jointly with the United States government. Three of the members of this consulting board are to be actively engaged in gravel mining in the hydraulic mining regions.

Goldfield, Nevada

Feb. 16—It is reported that George Wingfield is working on a consolidation to include the Booth, Columbia Mountain, Nighthawk, Ethel, Oro, Kewanas and Berkeley companies. The sums in the treasuries of the various companies would give a working capital of over $70,000 to the merger company, and the property would contain more than 300 acres of mineral ground adjoining the Consolidated on the north.

On March 1 the case between the Goldfield Consolidated and the Frances Mohawk Leasing companies will come to trial before Judge Stevens, of the District Court. The amount involved is $125,000 and arises from the contention of the Consolidated company that the mining operations of the leasing company were not performed in a miner-like fashion and that the workings were left in a dangerous condition due to the robbing of the mine. When the leasing company deposited $125,000 in a local bank some time ago, the Consolidated company filed a damage suit and attached the funds, whereupon the leasing company furnished bonds for the release of the same; this was contested in turn by the parent company which questioned the responsibility of the sureties.

A Tonopah miner was arrested in that city last week charged with high-grading from the Broken Hills mine, where he had been employed. A search of the quarters occupied by the prisoner disclosed about 600 lb. of rock averaging $3 per pound. High-grading has been suspected by the management for some time, and it is thought that the arrest will lead to the detection of several others similarly implicated.

Ore shipments from Tonopah for the week ending Feb. 13 were: Tonopah Mining Company, 3200 tons; Montana Tonopah, 640; Tonopah Belmont, 700; Jim Butler, 250; MacNamara, 200; Tonopah Midway, 100; and West End 100 tons, having a total estimated value of $130,000.

A deal was recently closed in the Pioneer district whereby E. S. Giles and W. B. Milliken assume control of the Indiana group. The new owners have started a working shaft about 200 ft. distant from the main shaft of the Pioneer. A hoisting plant will soon be installed. The Mayflower mill is now practically completed and on the arrival of the pump will be placed in commission.

The first dividend to the employees of the Ophir and Consolidated Virginia companies at Virginia City was paid Feb. 11. The dividend, amounting to $1956, was for the last three months and was divided among the employees according to their wage-earning capacity. This is an innovation in Nevada and its operation will be watched with interest.

Salt Lake City

Feb. 19—The Conkling Mining Company has filed supplemental proceedings in the Federal court against the Silver King Coalition Mines Company. The Conkling affidavit states that the King company shipped 14,400 tons of ore worth about $40 per ton, or a total of $576,000, besides 18,720 tons of concentrating ore, which when treated gave 6240 tons of concentrates valued at $40 per ton or $249,600. This gives a total gross value of $825,600. The cost of mining, milling, etc., is given at $421,440, leaving an alleged net value of $404,160 said to have been taken from the Elephant stope. The Conkling company, owning three-fourths interest in the ground, in which the Elephant stope is said to be, brings suit for $303,120. Mr. Treweek states that the Conkling company will sink a three-compartment shaft on the Conkling claim and expects to strike the ore near or over the Elephant stope at a depth of approximately 850 feet.

It is rumored that the United States

Smelting, Refining and Mining Company is trying to purchase the Knight smelter and the Colorado mine at Tintic.

Another test run of the Fink smelter will be made at Garfield as soon as Mr. Fink returns. Heretofore, coal was employed as fuel, but in the coming test oil will be used.

On account of the heavy storms, the Utah Copper Company has been experiencing considerable difficulty in getting ore transported between the mine and the mill at Garfield. The company will probably build a line of its own in the near future.

The annual report of the Ohio Copper Company for the year ending Jan. 1, 1909, which was published this week shows the following: Assets—Development, $75,151; mine surface equipment, $33,645; mining properties, $11,257,625; Columbia shaft, $38,142; treasury bonds, $129,000; treasury stock, $1,797,500; accounts receivable, $5317; construction concentrator, $778,034; cash, $60,540; miscellaneous, $19,538; total, $14,194,492. Liabilities—Capital stock issued $13,000,000; first-mortgage bonds, $1,000,000; accounts and bills payable, $194,492; total, $14,194,492. Authorized capital, 1,500,000 shares; held for conversion of bonds, 200,000 shares; $2,000,000 bonds are authorized, but only one half issued.

A body of low-grade ore was cut last week by the east drift of the Iron Blossom, about 140 ft. east of the north shaft. A raise from this drift has developed 15 ft. of black carbonate ore, high in lead and carrying considerable silver. This strike in the Iron Blossom made Feb. 15 the biggest day on the Salt Lake Stock Exchange since last June. This stock, which sold at $2.80 on Feb. 13, went as high as $3.25, and nearly 25,000 shares were sold. On the same day, 180,000 shares of Tintic Central sold at 20 to 25c. During the day 464,764 shares, having a value of $190,327, were sold. With the Iron Blossom stock selling at its present price, the property is worth about $3,200,000.

The Tintic ore shipments for the week ending Feb. 12 were: Centennial Eureka, 46 carloads; Eureka Hill, 5; Yankee, 2; May Day, 2; Eagle and Blue Bell, 1; Bullion Beck, 2; Sioux Consolidated, 15; Iron Blossom, 2; Ajax, 2; Dragon Iron, 23; Colorado, 20; Brooklyn, 6; total, 126 carloads.

Butte

Feb. 18—E. F. Frisbie, president of the Raven Copper Company, in a circular letter to stockholders, has placed the critical position of the company before them and has made a further appeal for subscriptions for the 63,000 shares recently offered. In the letter he states that unless a better showing is made by the stockholders by Feb. 24, the money already subscribed will be returned and the property closed down permanently until a plan of reorganization can be perfected. At the continued hearing of the case of Bliss against the Anaconda Copper Mining Company, held before Judge Hunt at Helena last Monday, the possibility of further abating the injurious effects of the Washoe smelter fumes was taken up. Superintendent Matthewson and J. R. Faulding, a chemical engineer from New York City, gave testimony on behalf of the company to the effect that the methods now employed by the smelter were the most advanced known to science and that the installation of any other method would mean the expenditure of several millions of dollars with merely problematical results. Further hearing was adjourned until Feb. 19.

At a recent meeting of directors of the Butte-Montana company, held in Pittsburg, an offer of Duluth capitalists to finance the company was favorably considered and the plan will now be put up to the stockholders. The plan contemplates the purchase by the Butte Alex Scott company of the property of the Butte-Montana in exchange for 50,000 shares of the former company's stock. The Butte-Alex Scott company is a Delaware corporation with a capital of $1,250,000, divided into shares of the par value of $10 each. In addition to giving the Butte-Montana company 50,000 shares of stock the Butte-Alex Scott company will also agree to pay off all indebtedness of the old company.

Deadwood, S. D.

Feb. 20—Notwithstanding the severity of the winter, mining and milling in the Black hills has been little affected. The North Homestake Company has temporarily suspended operations. It is generally reported that a change will be made in the method of ore treatment. The Gilt Edge Maid has also closed down, awaiting the completion of financial arrangements for enlarging the mill. The large slime tonnage handled by the Homestake company is soon to be increased by the addition of two new Merrill presses. The addition being made to the building will accommodate four presses, which should increase the total capacity to above 2000 tons.

The Golden Reward Mining Company is installing Moore filters for the treatment of the slimes. The present treatment is: Gates crusher to rolls, to Chilean and Huntington mills, to classifiers. The sand from the classifiers goes to leaching vats, and slime is treated partly in a Chamberlin press and partly by decantation. In the remodeled mill the slimes will go to a Dorr thickener, from which the underflow will go direct to the Moore filters. Stearns, Roger & Co., of Denver, Colo., are putting in the new equipment. The Moore process of filtration will also be used in the new mill now under construction for the Golden Crest Mining Company. Here the pulp from the stamps will go to the Dorr classifiers, the sand being reground in tube mills; the tube mill discharge joining the slime overflow from the classifiers, will go to Dorr thickeners, from which the underflow will be agitated by a Gordon worm. The feed from the latter will flow direct to the Moore filters.

Denver

Feb. 20—Work in the tungsten belt in Boulder county seems to be increasing, but operators in general appear to be awaiting the action of Congress on a revision of the tariff, and a hoped-for duty to be imposed on foreign imports of that metal. The fight for the control of the Daly-West mine at Park City, Utah, which has been waged in Denver for some days past, between McCornick, the Salt Lake banker, and his friends, and J. J. Daly, the discoverer, and his friends among the Cincinnati stockholders, has resulted in defeat for the Daly party, and the old management remains in control. Charges and countercharges of mismanagement and fraudulent intent were freely made on both sides. It was stated that there is $320,000 in the operating fund, and that owing to the low price of silver and lead, no dividend was paid last year—the first time in nine years that a dividend has not been declared.

There is now a good deal of activity in what is known as the Rangely oil district, in Raven Park, Rio Blanco county, and on the projected line of the Denver, Northwestern & Pacific railway, now under construction. Some years ago six test wells were drilled, and oil was struck in several of these wells, which were put down as deep as 2000 ft., and have 200 ft. of oil in them, and of such fine quality that the people in the vicinity burn it in their lamps instead of buying refined oil. Owing to the then uncertainty of a railway, and other causes, work ceased. Now, however, the Gilson Asphalt Company has a drill in there, with a capacity of 6000 ft. depth, and a private syndicate of Vernal, Utah, men has installed a drill with a 2500-ft. capacity, commencing operations on Jan. 19, and are now down 1000 ft. The activity in railway construction in this part of the West is the stimulus for these and many other mining operations.

Indianapolis

Feb. 22—The prospects for a good summer's work at the mines in the Jasonville field was never brighter than at the present time. It is stated that the Lattas Creek, Island Valley and Bogle mines, three of the largest in the field, have closed contracts for sufficient orders to

keep the mines running at full time for at least four months.

An important sale of mining property in Greene county was closed by the transfer of 560 acres in Stafford township to a Chicago syndicate. The land is underlaid with a 4½-ft. vein of the best coal that has been discovered in the Linton district for several years.

The coke ovens at Black creek mine in Greene county will soon be placed in operation. Fires have been kindled in the ovens, and it is asserted that a big contract for coke for Gary is promised if the product proves satisfactory.

Victoria, B.C.

Feb. 16—A bill was recently introduced into the provincial legislature of British Columbia with the object of protecting miners and other wage earners against a class of men, chiefly foreigners, who obtain options or working bonds on mining properties, employ men to do work, and then fail to pay them. The bill required such an operator to obtain from a responsible banker a certificate that he had on deposit in the bank sufficient money to pay two months' wages to the men he employed. While the government admitted that in some cases men were defrauded of their wages by irresponsible operators, in the way indicated by the supporters of the bill, it was not deemed advisable to pass the legislation asked for, since it could be carried to extremes, for it should not be applied to miners only, but to all classes of labor. Other serious objections were also raised to the measure, which was voted down by a vote of 22 to 13.

An attempt made by a socialist member of the provincial legislature of British Columbia to secure the enactment of a measure providing for the extension of the provincial eight-hour law, which limits the work of miners underground to eight hours per day, so as to apply to men working in open-pit mines, has been defeated. The premier, who is also minister of mines, argued, first, that there does not exist a general demand throughout the province for the enactment of the proposed amendment to the existing law, and, second, that it is not necessary for the physical protection, as had been claimed it is, of any large number of men. The socialists, the premier added, would like to have the eight-hour law made applicable to all phases of industry, which would greatly retard industry in the province. Particularly with the mining industry, as proposed in this instance, would it prove a drawback, and that industry, owing among other things to the considerable fall in the price of copper, needed encouragement rather than more restrictive legislation. Under the circumstances, therefore, it was necessary for the provincial government to move slowly in making changes. The bill was rejected by a vote of 23 to 14.

London

Feb. 13—During the six months ending Dec. 31, 1908, the report of the Dolcoath mine, Cornwall, shows that there were raised and milled 49,869 tons of tin ore, producing 902 tons of black tin or 40.52 lb. per long ton. The average price of black tin during this period was £77 17s. 2d., and the amount realized £70,238. The average receipts per ton of ore were 28s. 11d., and the total working costs 24s. 8d. per ton. The lords' royalties amounted to 1s. 11d. per ton, so that the company's net profit amounted only to 2s. 4d. per ton, or a total of £5891.

Some good ore is being met with at the bottom of the mine, a depth of 2940 ft.

The new vertical shaft being sunk to cut the lode at the 490-fathom level was down 2274 ft. at the close of the year, when there were still 666 ft. to sink. During the last six months the rate of sinking has been only 42 ft. per month, owing to trouble with water. Progress had been previously at the rate of 60 ft. per month. The cost of sinking during the last six months has averaged £30 per foot. The scheme of equipment for the new shaft has not yet been finally decided on, but it is understood that the pumping and hoisting plant will be electrically driven. To meet the capital expenditure required to complete the shaft the company has over £50,000 in cash or investments. The company's issued capital is £340,000 in £1 shares, which are valued today in the market at about 15s. Deducting the cash reserve, the mine may be said to be valued at £200,000.

If this is a fair value for the most famous mine in Cornwall, which is making some profits, and which promises to do much better in the future on account of the facilities for cheaper working that the new vertical shaft will afford, one wonders how it is that people can be found to buy shares in undeveloped mines in the same locality capitalized at double the amount. Yet at the present time business is being done, at prices that make the property far more valuable than Dolcoath, in the shares of a company that has acquired some of the old tin mines in the St. Ives district. The foundation of the boom in these particular mines is the occurrence of pitchblende, the radium contents of which are in some vague way to bring immense riches to the shareholders. How much pitchblende there is and what its commercial value is are questions that those who are buying the shares at high prices do not apparently stop to inquire. They must not, therefore, be surprised to find some years hence that mining for radium is not so profitable a business as the company promoter would have them believe.

Paris, France

Feb. 5—The government of the Régency of Tunis is going to receive bids for the last portions of the line of the Nefzas. This line—length 75 km.—will secure an outlet on the Bizerta harbor for the rich iron mines of Kroumirie. The concessions, covering 5437 hectares, belong to the Compagnie des Mines de Fer de la Kroumirie et des Nefzas, which was promoted in 1906 by the Compagnie de Mokta-el-Hadid and the Compagnie des Mines de Fer des Nefzas. The mines were discovered early in the French occupation, but the presence of arsenic, though in small quantity (0.07 per cent. on an average) for a long time prevented their opening. They are mostly workable by open pit, rich, generally above 55 per cent. iron, and free from sulphur. They consist of very irregularly shaped lenses of partly hydrated silicious hematites, having generally an interstratified appearance, under the upper Eocene sandstone and over marl deposits of the same age. These ores will secure a return freight for the steamers that supply the important military harbor of Bizerta with coal. The absence of sulphur and phosphorus makes them compare favorably with the Bilbao ores.

The Nefzas line will also serve important concessions of zinc and lead, especially the Djebel-el-Grefa, belonging to the Compagnie Royale Asturienne des Mines. The ore appears as clayey lead carbonate of an almost constant average of 10 to 12 per cent., cementing together beds of conglomerates resting on Trias and of a thickness ranging between 100 and 200 m. The concentrating plant now erected has a capacity of 200 to 220 metric tons of ore per 24 hours.

A company is being formed to work alluvial gravels and auriferous laterite in Vakinankaratria province, in Madagascar. This company proposes to use Turner gold-saving tables in place of the old-fashioned *batea,* or pan.

It is also reported from Madagascar that an English engineer, Mr. Burls, has just discovered bituminous deposits in the Mevatanana region, at 200 km. from the coast, which may be evidence of the presence of oil deeper down.

The Compagnie des Chemins de Fer du Congo Supérieur aux Grand Lacs Africains has discovered a chalcopyrite bed of high tenor at 7 km. from Pontierville station. The last steamers from the Congo brought over specimens of ore, the average yield of which is said to be 30 per cent. copper. The company has started prospecting to determine the importance of this bed.

The French Chambers are about to discuss the matter of the Ouenza iron mines, Algeria, belonging to a syndicate in which some important French, English and German firms are concerned.

Mining News from All Parts of the World

New Enterprises, Installations of New Machinery, Development of Mines and Transfers of Property Reported by Special Correspondents

THE CURRENT HISTORY OF MINING

Alabama

ETOWAH COUNTY

Quinn furnace at Gadsden is to be sold at public sale April 17. It has not been in blast for some time.

FRANKLIN COUNTY

Eureka Mining and Development Company—This company has sold its brown ore mines near Russellville to a syndicate represented by Henry B. McCormack, of Pennsylvania, for $180,000. The property consists of 420 acres of ore lands and two mines which can ship 500 tons daily.

JEFFERSON COUNTY

Woodward Iron Company—Contracts have been let for grading and stripping at No. 2 iron mine at Red Mountain. A large tipple and crushers will be put up and the shipping capacity increased to 1000 tons of ore daily; at present it is 500 tons.

California

AMADOR COUNTY

Central Eureka—The main shaft is now 2120 ft. deep. The bottom of the old caved shaft will be reached in about four months.

South Eureka—Twenty stamps of the Central Eureka Mining Company's mill are working ore from this mine. The ore is conveyed from mine to mill by electric overhead tramway.

BUTTE COUNTY

Francisco—A stamp mill will soon be installed at this property at Enterprise where a rich vein was found some months ago.

DEL NORTE COUNTY

Oro Del Norte—This company, Dr. T. R. Heintz manager, has purchased the Dowdle property on the ocean beach near Crescent City, and an electric plant for saving the gold from the black sands of the ocean beach will be installed.

EL DORADO COUNTY

Sherman—Handsome specimen rock is being taken from this mine, near Placerville. Thos. Clark is superintendent.

Union—M. L. Effinger, resident manager of the San Francisco company which recently took charge of this mine at El Dorado has kept 10 stamps running during January and will soon start up the other 10. This is a very old mine which has only been worked intermittently of late years.

HUMBOLDT COUNTY

David Minor has found a bed of talc 2 ft. thick at Glendale in the northern end of the county.

INYO COUNTY

Custer District—A new railroad is being built within 15 miles of this new mining camp, which is in the Argus range northwest of Death Valley and east of the Mohave desert. A great number of locations have been made and numerous prospectors have gone into the district in the past two months.

MONO COUNTY

Casa Diablo—The drifts which have followed the Dawn of Hope and Dry Bone veins have come together at about 300 ft. in from the tunnel. The ledge shows about 20 in. of good ore.

NEVADA COUNTY

Banner Ridge Drift—This company has been formed at Grass Valley with S. H. Dille as president and J. M. Wiley as secretary, to develop claims on the Wallace Macdonald ranch on Banner Ridge. There is already a hoisting and pumping outfit in place and an incline is being run to tap the gravel channel.

Brunswick—This company, with J. W. Pew as president, will sink a new vertical shaft to the east of the old one. The mine was formerly a producer; C. H. Mallon is now superintendent.

Last Chance—This mine near Maybert has been bonded by J. M. Fly, of the Marcotte company.

Oustomah—Operations have been partially suspended and the mill has been closed. Certain development work, however, is to be continued. The mine has reverted to its owners, the bondees having quit.

PLACER COUNTY

Southern Cross—The dam went out about two weeks since and it was impossible to run the mill, while the dam could not be repaired until spring. Therefore a gasolene engine was purchased and hauled with great difficulty over the narrow mountain trail through the snow from Gorge.

PLUMAS COUNTY

Star Spangled Banner—This group, including the Flagstaff and Pennant claims, on Rush creek not far from Greenville, is about to be thoroughly prospected.

SHASTA COUNTY

Hazel—The company, operating the Gladstone mine at French Gulch, has purchased an electric locomotive for use in its 4000-ft. tunnel.

SISKIYOU COUNTY

Gardner & Weed—Water has been turned into the ditches at Fort Jones and a full crew is now handling the three giants.

Granite & Crosscut—At the Granite mine on Humbug creek, Chas. A. Mitchell manager, very good ore has lately been taken out. The mill has been overhauled and put in order.

TRINITY COUNTY

Trinity Gold and Timber Company—This company, W. V. Whipple manager, operating the Beaudry mines at Minersville, has installed three giants and has an abundant water supply. The company is making arrangements to install a dredge on the low benches of the property.

TUOLUMNE COUNTY

McCormick—The property near Jacksonville, Edward Butt superintendent, has a new pipe line, and high-grade ore is being taken out.

Springfield Tunnel—This mine, near Columbia, has had considerable trouble with water and heavier machinery has been installed, including a new air compressor.

Gold Ship—At Groveland, Wm. Graham superintendent, arrangements for working on a large scale are being made. It is owned principally by Kansas City and Boston men.

Colorado

LAKE COUNTY—LEADVILLE

Alice Placer—A new shaft is being sunk on this ground, Carbonate hill, by lessees and when sufficient depth is gained, drifting toward the Penrose will be started. A large body of iron ore exists on the Penrose line.

Baby Shaft—A large body of low-grade iron ore has been opened in this property,

Iron hill, but as work proceeds on it the value increases.

Cleveland Shaft—This shaft, South Evans gulch, is now down 760 ft., leaving 65 ft. to be sunk to complete the present contract of 200 ft. The shaft is being sunk in porphyry and but little trouble is encountered from water.

Coronado—The lessees on this property, Down-town section, have opened up a large body of argentiferous iron, and during the week put on a double shift of men. Shipments at the rate of 30 tons daily are being sent to the smelter.

Ibex—Connections have been made between shaft No. 3 and No. 4 from the lower level of the latter shaft. This permits the ground between the two shafts to be thoroughly drained, and will also allow development work to be carried on at greater depth in No. 3 shaft.

Lilian—The lessees on this property, Iowa gulch, are shipping ore that will run high in gold. The work is being carried on at the lower levels.

Yak Tunnel—Ten drill holes have tapped the water in the Resurrection and it is being lowered at the rate of 12 ft. per day. The tunnel is now being driven ahead into Big Evans basin.

SAN JUAN COUNTY

Ross Mining and Milling Company—This company is now operating the old Congress mine at Red Mountain. Development work has been begun on the 270-ft. level of the old shaft. J. B. Ross is manager and Patrick Lonergan, superintendent.

Florida

Prairie Pebble Phosphate Company—The Holmboe Company, Louisville, Ky., has taken the contract to build extensive additions to this company's plant at Mulberry.

Georgia

LUMPKIN COUNTY

Liberty Bell Gold Mining Company—A new ditch, 22 miles long, is being built to carry water to this company's mine near Auraria.

Indiana

SULLIVAN COUNTY

Following the suit for a receiver for the Hudson Coal and Mining Company, other suits on account are being filed. The debt was supposed to be about $3000, but the amount has grown to nearly $50,000, and other claims and assets are to follow.

Fire broke out again in the Shirley Hill Company's Clover Leaf mine, in the east part of the county. The fire is the fifth in a few months in that mine. The coal contains an unusual quantity of gas.

WARRICK COUNTY

Patrick Bartley, boss of the Menden coal mine, near Boonville, has been arraigned before Justice Youngblood on three charges prepared by the State mine inspector. The charge of acting as his own fireboss was sustained and a fine imposed. The charge of not having his mine inspected on Aug. 10 was continued for a future hearing.

Michigan

COPPER

Winona—This company has levied an assessment of $1 per share payable March 9. This is to furnish additional funds for development work and the erection of a stamp mill, which will be owned jointly by this and the King Phillips company, now under the same management. This will be a four-head mill located on the banks of the Sleepy river and near the working shafts of the two companies. The lower levels of both companies are encountering good ground and the Winona has sufficient ground blocked out to ship about 800 tons daily to the mill, for a number of years.

Isle Royal—The shaft that this company is sinking to open up the Baltic lode is down about 110 ft. At No. 6 shaft the new boiler house and the air compressor have gone into service and will soon be followed by the new high-duty hoisting engine.

Lake—Sinking continues below a depth of 460 ft. in good, copper ground. Preparations for the third level have been made at a depth of 415 ft. Drifting continues on the two upper levels.

North Lake—Diamond drilling continues at this property making two parallel cross-sections of the tract.

Seneca—This company has driven the crosscut from the first level, a distance of 250 ft. from surface, a distance of 75 ft., and the formation indicates close proximity to the formation. Diamond-drill cores taken from the site showed mineralization.

Ahmeek—The erection of the structural steel for the new stamp mill is to be rushed so that the building will be ready in the early spring. At the mine alterations are being made at the central crushing plant to take care of the increased production that will be made when its mill is ready to go into commission. Sinking has been resumed at No. 3 shaft after completing the concrete collar which extends through the overburden a distance of about 70 feet.

Missouri

WAYNE COUNTY

Wayne Iron and Lumber Company—Development work has been begun on a large deposit of iron ore near Greenville. W. N. Mitchell, of Chicago, is president.

ZINC-LEAD DISTRICT

Kenmore—This company has been incorporated with a capital stock of $100,000 to operate near Carl Junction. H. D. Hanway, manager, D. V. Sholl and other Joplin parties are the stockholders.

Little Princess—This company has sold the largest pile of reserve ore in the district. The sale amounted to 1,991,920 lb. of jack.

Little Maxine—A contract for a 200-ton mill on this lease near the Emma Gordon, has been let. J. L. Call is manager.

Maltes Brothers—The new 500-ton mill west of Joplin has started grinding ore.

Sarcoxie—This camp is taking on the appearance of a boom; 21 shafts have been sunk since the middle of December. The Optimo company has let six subleases on its ground.

Montana

BUTTE DISTRICT

Amalgamated—At the St. Lawrence, Never Sweat and Anaconda mines operations are still considerably retarded by gases from the mine fires. On the 1600 level of the Anaconda a connection has been made with the Belmont shaft. The Belmont is being sunk for the purpose of enabling the working of the Anaconda group at a point below the fire zone, the plan being similar to that being put in execution at the Tramway shaft of the Red Metal Company, where the Minnie Healy mine is being worked at a depth below the fire zone. Although there has been no recent reduction in the force employed in the Amalgamated properties, the number is only about two-thirds as great as that of two years ago. Production in comparison to the number of men working is greater than ever before.

Butte-Montana—The mine was shut down the latter part of last week for the purpose of installing new machinery, the present plant being no longer able to do the work at the depth reached.

Reins—It is reported that this property is shortly to be opened up.

JEFFERSON COUNTY

Corbin Consolidated Mining Company—The entire outstanding stock of the company is under option to J. L. Meixell, of Butte. This property directly adjoins that of the Boston Corbin Company and comprises four claims.

Nevada

ESMERALDA COUNTY—GOLDFIELD

St. Ives Lease—This lease, managed by A. A. Codd and located on the St. Ives claim of the Goldfield Merger Company's ground, shipped 15 tons last week to the

Nevada Goldfield Reduction Company; the ore averaged about $60 per ton.

Great Bend Diadem—Recent developments in connection with the strike reported on this property last week have proved it to be one of very great importance, since examination has shown the orebody to be associated with dacite. This fact has great bearing on the question of permanency, as in no instance in Goldfield, excepting the Sandstorm, have permanent orebodies been found unassociated with the dacite. A shipment is now being prepared.

Goldfield Daisy—Sinking is to be resumed in the No. 2 or Truett shaft, and carried on from the 400-ft. to the 700-ft. level. At present most of the ore shipped is taken from the old shoot on the 200-ft. level, and a lesser amount from the 300-ft. level. The crosscut on the 400-ft. level is being pushed to get under the oreshoot.

ESMERALDA COUNTY—PALMETTO

Palmetto Death Valley Mining Company—Work has been resumed on this ground by men holding an 18-months' lease on the mine and mill. Ore is being taken out and hauled to the mill, five miles distant. The ore is of milling grade averaging about $18 per ton.

ESMERALDA COUNTY—GOLD MOUNTAIN

Nevada Empress—It is reported that the mill will be placed in commission by March 15. In a well recently sunk, sufficient water has been developed to supply a 30-ton mill; a pipe line connecting the well and mill has been laid, and an engine and pump installed. A new vein, 3 ft. wide, was recently cut; samples from it assay $20 per ton. Fifteen men are now employed on the property.

ESMERALDA COUNTY—HORNSILVER

Great Western—The outlook for this property is favorable, as ore is being shipped from both levels. Development work is also being carried on. On the 200-ft. level ore is mined in both the east and the west drifts, the ore assaying well in gold and silver. On the 300-ft. level in a raise east of the shaft, a streak, 18 in. wide has been opened which also assays well in gold and silver. The ore is at present shipped to the Belmont mill at Millers.

Cottrell Group—A strike is reported on this property which lies immediately east of the Great Western. The property has been worked intermittently for some months. Ore was first found at a depth of 15 ft. in a shaft sunk to intercept a blind lode. The vein was lost, and a new shaft was sunk to prospect for it. In this new shaft at a depth of 55 ft. the vein was picked up and had been drifted upon for a distance of 35 ft. The vein is 4 ft. wide and contains much shipping ore. About ten tons of this gold and silver ore are now ready for shipment.

ESMERALDA COUNTY—RAWHIDE

Rawhide Queen—The company has found the orebody in the Kerns' No. 2 lease which was abandoned some time ago by the leasers after considerable prospecting for the oreshoot. This shoot of ore is rich and contains considerable visible gold, some large specimens of native gold having been found in the vein. The Kerns No. 1 lease continues to ship a good grade of ore. The Domiac lease also continues to ship a good grade of ore. The shaft at this lease is to be sunk deeper. At the St. Ives lease, also on the Queen property, a drift is being driven to catch the oreshoot worked in the Kerns No. 2 lease. Lately a body of rich ore was struck in this lease.

Murray Lease—The mill is running regularly on the ore from the lease. Recently a streak of rich ore was found on the 200-ft. level of this lease.

Marigold Lease—A good body of rich ore was found on the 130-ft. level last week. The Marigold lease and the Grutt Hill-Truitt leases are worked through the same shaft.

Grutt Hill Mint—Rich ore has been found on the 320-ft. level of this lease on the Coalition property. The orebody has been crosscutted for 6 ft. without reaching the footwall. This company has acquired the Grutt Hill Coalition lease which adjoins the Mint lease. The two leases will henceforth be worked through the Coalition shaft, which is vertical, instead of through the Mint shaft which is an incline.

NYE COUNTY—TONOPAH

Jim Butler—This property shipped 250 tons of ore during the week ending Feb. 13. This ore came from the 100-ft. and the 200-ft. levels. No development work is carried on at present.

MacNamara—At a meeting held Feb. 6 a dividend of 1c. per share was declared payable March 5, the books of the company closing for transfer Feb. 20. Sinking was resumed Feb. 10 in the main shaft, now 500 ft. deep. This shaft is to be sunk to a depth of 800 ft., at which point a drift will be started to find the body of quartz cut by the drill at a depth of 785 feet.

Tonopah Mining Company—At the Mizpah shaft the water column was placed in position last week from the 1200-ft. level to the surface. The station has been completed, and work has commenced on the foundation for the pump. The usual amount of development work was carried on in all the levels, 360 ft. of new ground being broken. At the Silver Top shaft, the drill hole from the 740-ft. level is now 435 ft. below that level; 126 ft. of new ground was broken during the week. At the Red Plume shaft, sinking was resumed on Feb. 10; this shaft, now 500 ft. deep, will be sunk to a depth of 700 ft. On the 600-ft. level, prospecting for the quartz cut by the drill at that depth will be done. At the mill 3170 tons of ore, valued at $21.50 per ton, were crushed during the week; 64 bars of bullion worth $53,760 and 52,000 lb. of concentrates valued at $12,300 were shipped.

Tonopah Belmont—In a raise from the west drift on the south vein on the 1000-ft. level, 4 ft. of good milling ore was opened last week, and in a raise from the west drift following the Mizpah fault on the 1000-ft. level another orebody 4 ft. wide and containing good milling ore has been found. The stope from the 1100-ft. level shows a big orebody of good milling grade, more than 10 ft. wide.

NYE COUNTY—ROUND MOUNTAIN

Round Mountain Mining Company—The clean-up for the month of January, during which month 2770 tons of ore was treated, amounted to $33,600. The company will increase the capacity of the mill to 110 tons; it is negotiating with the Nevada Electric Power Company for an extension of its lines from Millers to Round Mountain.

HUMBOLDT COUNTY—SEVEN TROUGHS

Harris Lease—In sinking a winze from the 200-ft. level an oxidized vein was cut which shows a good milling ore for a width of 10 ft. In drifting on an east and west vein that was cut in a crosscut on the bottom level of the property, a round of shots disclosed the entire breast to be of high-grade shipping ore.

Wihuja Lease—This property is preparing a shipment to the Kindergarten mill. This ore comes from the 375-ft. level and is the best ore ever taken from the mine.

Mazuma Hills—At the Prior-Chadbourne lease, a rich strike is reported on the 250-ft. level where 15 in. of rich ore has been opened. Three inches of this is very rich talc, and the remaining 12 in. black quartz of shipping grade. The oreshoot is on the Reagan vein from which one carload sent to the smelter averaged $1030 per ton.

Pennsylvania

BITUMINOUS COAL

Pittsburg-Westmoreland Coal Company—This company is offering $500,000 in 5 per cent. first-mortgage bonds, part of an authorized total of $6,000,000, of which $3,325,000 are outstanding. The company owns 16,500 acres of coal lands, and has eight large mines in operation, with two others being opened.

Texas

LLANO COUNTY

The rich deposits of iron ore in this county are being examined by Dr. William B. Phillips, of Birmingham, Ala. The

property will be prospected by diamond-core drilling, test pits and shafts. Steam drills will be used and a thorough examination made; the work will probably take several months. The ores are magnetites and hematites, in granite and gneiss, and are known to be rich, carrying 60 to 65 per cent. iron, and not over 0.05 phosphorus. The property belongs to R. H. Downman, of New Orleans, and the Wakefield Iron Company, of Minneapolis. It is about 15 miles northwest of the town of Llano, which is 100 miles northwest of Austin. The chief object of this examination is to determine the commercial value of the deposits.

South Dakota

Lawrence County

Burlington—It is reported that development work is to be resumed upon the property. The shaft is down 180 ft., and will be sunk 250 ft. before drifting is commenced. The vein followed dips almost vertically.

Rainbow—At the annual stockholders' meeting, held at Deadwood Feb. 15, the following directors were elected: John Baker, W. H. Bonham, Clara D. Coe, E. M. Dale, J. H. Gerard, W. A. Ickes, E. P. Peterson. E. P. Peterson was elected president; E. M. Dale, vice-president, and Clara D. Coe, secretary and treasurer.

Utah

Juab County

East Crown Point—The shaft, now 140 ft. deep, will be sunk to a depth of 300 feet.

Tintic Development Company—High-grade lead ore has been struck in the face of the north drift at a depth of 230 ft. Hoisting equipment and a four-drill compressor have been ordered.

Salt Lake County

Boston Consolidated—The annual report of the company shows expenditures during last year of $832,266 upon construction and development, of which $651,883 was expended upon the Garfield mill and $70,766 in steam-shovel stripping of overburden. A total of $937,658 was received from the sale of metal, which was all put back in the property for operating and construction. At the Garfield mill recoveries range from 70 to 72 per cent., and milling costs were reduced from $1 to 47.2c. per ton. About 2000 tons of ore are treated daily.

Philippine Islands

Benguet

Benguet Consolidated—This company reports for the month of November a production of 209 oz. gold and 310 lb. cyanide bullion.

Headwaters Mining Company—The prospect adits on this company's property are showing good ore, carrying free gold. On the northern lead the adit showed good returns, but to avoid trouble from floods it has been closed, and another started higher up the hill, where the entrance and dumps will be safe from flood waters.

Camarines

Another dredge has arrived at Paracale and as soon as the pontoons are erected and the machinery installed active operations will begin on the headwaters of the Paracale river. J. H. Jones is in charge of the installation. This dredge is the property of New Zealand men.

Paracale Gold Dredging Company—This company, operating on the Paracale river, reports a saving of 626 oz. gold in November.

Tumbaga—This old mine has been pumped out and prepared for the installation of machinery. Samples taken out have proved satisfactory, and much of the old machinery is in good condition. This will be reinforced by additions to the equipment and it is expected that the mine will be in operation and milling started in February or March.

Canada

British Columbia

A statement of the revenue and expenditure of the province for six months ended Dec. 31, 1908, recently submitted to the local legislature, reports that the revenue from the mining industry during that period was as follows: From free miners' certificates, $11,067; general mining receipts, $58,890; mineral tax, $58,134; tax on unworked Crown-granted mineral claims, $21,362; royalty and tax on coal, $82,950; sundry receipts not specified, estimated at $17,000; total, $250,403 for the half-year.

British Columbia—Trail

During 1908 there was smelted at the works of the Consolidated Mining and Smelting Company of Canada, Ltd., at Trail, ore as follows: In lead furnaces, ore and concentrates, 51,022 tons; in copper furnaces, 267,384 tons; total, 318,406 tons. The metal production was:

	Quantity.	Gross Value.
Gold, oz.	116,314	$2,383,327
Silver, oz.	2,100,457	1,102,843
Copper, lb.	3,753,139	506,460
Lead, lb.	35,999,145	1,050,455
Total value.		$5,043,088

Included in the output was the production of the company's St. Eugene lead-silver mine at Moyie, Centre Star group of gold-copper mines at Rossland, Snowshoe mine (leased) at Phœnix, Boundary district, and custom ores and concentrates purchased.

British Columbia—Vancouver Island

The total output of coal in 1908 in the Coast district was 1,229,328 long tons. The greater part of this production was from the mines of the Wellington Colliery Company, at Cumberland and Extension, and of the Western Fuel Company near Nanaimo, all on Vancouver island.

The corporate name of the company heretofore known as the Britannia Smelting Company, Ltd., is to be changed to the Britannia Mining and Smelting Company, Ltd. The new company, the stock in which is largely held in New York, will be an amalgamation of the Britannia Smelting Company and the Britannia Copper Syndicate. The latter owned, and has been operating for several years, the Britannia group of copper mines, near Vancouver, and the former the smelting works at Crofton, Vancouver Island. T. Mason Adams will continue as general manager.

British Columbia—Boundary

At Vancouver, in the Supreme Court of British Columbia, Mr. Justice Clement has adjourned the case of the National Trust Company, of Toronto, Ont., acting as trustee for the bondholders, against the Dominion Copper Company, so as to give counsel opportunity to agree as to which of the assets of the defendant company are exempted from the plaintiff's security in connection with the bond issue made in June, 1905. Plaintiff asks for a foreclosure order to include all the assets, but defendant claims that certain of the assets are not included in the plaintiff's security.

British Columbia—Nelson

J. McMartin, well known at Cobalt, where he is interested in the La Rose and other mining properties, has arranged to acquire the Kootenay Belle and Mother Lode groups of mineral claims, in Sheep Creek camp, Nelson division. From half a dozen properties in this camp nearly $700,000 in gold has been produced, of which more than $100,000 was from the Kootenay Belle and Mother Lode. Hitherto development of these two mines has been on only a small scale. On the Kootenay Belle tungsten, occurring here in association with the gold ore, is stated to be in the purest form yet found in Canada.

British Columbia—Trail

A return made by the secretary of State for Canada shows that, beside gold and bronze coins made at the Canadian branch of the Royal Mint, Ottawa, Ontario, at which coinage was commenced last year, there has been coined $313,338 in silver, purchased from the Consolidated Mining and Smelting Company, of Canada, Ltd. This company supplied the mint with 387,859 oz. of fine silver, which was smelted and refined at its works at Trail.

British Columbia—Slocan

Another stage has been reached in the Star Mining and Milling Company vs. Byron N. White Company litigation, the Supreme Court of Canada having dismissed the appeal of the defendant company against the judgment of the Full Court of British Columbia, which was in favor of the plaintiff company. This case has been before the courts for years. It involves questions of extra lateral rights.

Ontario—Cobalt District

Ore Shipments—Shipments of ore from Cobalt for the week ending Feb. 13 were as follows: City of Cobalt, 61,000 lb.; Crown Reserve, 41,970; La Rose, 194,140; McKinley-Darragh, 40,000; Nipissing, 128,957; Silver Queen, 65,000; Trethewey, 92,530; total, 623,597 pounds.

Cobalt-Majestic—This company, formerly the Abitibi & Columbia, has been ordered by the Provincial secretary again to change its name on account of the confusion arising between it and the Kerr Lake-Majestic.

Right of Way—At the annual meeting held at Ottawa Feb. 17, a dividend of 6 per cent. with a 9-per cent. bonus was declared for the quarter ending March 31. In was announced that the company would be placed on a 6-per cen. quarterly basis with whatever bonus in addition might be advisable. The value of the output for the year was $215,000.

Silver Queen—The directors have decided to pass the usual dividend of 3 per cent. per quarter. President F. L. Culver stated that the company had plenty of money on hand, but having run into a lean streak of ore, the directors considered it advisable to retain it in order to keep up development work until good paying ore was again reached.

Ontario—Gowganda

Bartlett—About 20 men are at work completing the construction of large camp buildings. Active mining work will begin in about two weeks.

Yukon Territory—Whitehorse

The local board of trade has resolved to ask the Yukon territorial authorities for an appropriation of $5000 for the cable ferry over the Donjek river and for improving the road from Whitehorse by Kluane to the White river country, in which numerous copper claims have been located on both sides of the International boundary line. It is claimed that those in charge of International boundary survey parties support the Whitehorse-Kluane route as the best.

Frederick T. Congdon, recently elected member of the Dominion House of Commons for Yukon Territory, has announced his intention to endeavor to secure an adequate appropriation for more roads in the Yukon, especially along the White, Stewart and McMillan rivers, on which important mining enterprises have been undertaken.

Mexico

Chihuahua

Bullion Shipments—Recent bullion shipments passing through the banks of Chihuahua include the following: Batopilas, 205 bars silver valued at 216,000 pesos; Watterson, 11 bars gold-silver of value of 26,000 pesos; Benito Martinez and Martinez & La Rive, each 2 bars silver valued at 2000 pesos each.

Naica—As the result of recent ore discoveries more interest is now evinced in this district and a number of the newer companies have increased the extent of development operations, among these being the Compañia des Mines de Chihuahua and Naica Mining Company. A recent directors' report shows that the Naica company shipped during 1908, 16,820 tons of ore and that there is still available for immediate extraction upward of 140,000 tons.

Sonora

Candelero—The mines, at La Barranca, have been acquired by this company of Oklahoma City and are opening up five different veins of gold-silver ore. A tunnel is being driven into Candelero mountain to cut the Candelero vein, the mother vein of the section. This tunnel is now in 500 ft. with 300 ft. to go. A compressor plant, concentrating tables, and a cyanide plant will be installed soon. S. Been Smith is superintendent.

Creston Colorada—The Colorada mill is treating 5000 tons of Colorada ores per month, which are running from $8 to $20 per ton. The old Grand Central mill, leased by this company, is regrinding by tube mill and is cyaniding in the old original Butters plant about 8000 tons per month of the old tailings of the Colorada mill. These tailings are from both Colorada and Creston ores. The Creston mine is closed down. These mines are at Minas Prietas, about 20 miles east from Torres on the Sonora railroad.

La Dura—The Cananea Rio Yaqui y Pacifico railroad has its construction camps as far up the Yaqui river as La Dura and in the five camps between there and the present end of the road has 1500 men at work on construction. The track-laying machine is expected to reach La Dura about April 1.

Las Goteras—The mine, one-half mile from La Barranca, is preparing to install mining and milling machinery. A telephone line is being constructed to connect San Javier, Las Goteras, Candelero, and Toledo, with La Dura. Fred Foreshaw is mine superintendent.

Minneapolis Copper Company—This company at San Antonio de la Huerta is running its mill on free milling ore recently opened up by the new management.

Sonora Mining and Development Company—The Las Animas mine of this company, in the San Javier district, is being pumped out. When this is accomplished experiments will be made on the ores in the bottom of the mine to determine the process of treatment best adapted and a plant will be constructed. Frank Davis, of Alamos, is the general manager.

Southern Republic Mining Company—The Southern Republic, operating west of Noria on the Sonora railroad, is prospecting for copper with churn drills.

Yaqui Smelting and Refining Company—It is reported that the company's silver-lead smelter at Toledo is to resume operations. Frank Davis, of Alamos built the plant but was obliged to close down on account of Yaqui Indian outrages.

Greene Gold-Silver Company—On Feb. 12 the concession to W. C. Greene, covering nearly 3,000,000 acres of mineral-bearing ground in Chihuahua and Sonora, expired by limitation. There was immediately a rush by prospectors and miners to secure many valuable locations on the then open territory, but to the disappointment of the denouncers the local officials refused to file the claims. The reason of this refusal has turned out to be that special orders were sent to the Chihuahua officials not to accept denouncements on that territory until further notice, on account of an investigation pending to determine whether or not Colonel Greene has fulfilled the terms of his concession.

Lista Blanca Copper—This company has been incorporated at Nogales under the laws of Arizona to hold the total capital stock of the Compania Minera de Cobre Lista Blanca, S. A., the Mexico corporation owning the Lista Blanca property in the Altar district about nine miles west from Caborca. The property has a great deal of development work and considerable ore blocked out and it is the intention of the new company to install a modern reduction plant. Henry Levin is resident agent.

Noria—This new town on the Sonora railroad is the distributing center for the Sonora Copper Company, La Cobriza Mining Company, and the Llano Copper Company. The first two are said to be contemplating the early erection of smelters.

Tribune—In the Rey de Oro mine beyond Cerro Prieto in the Magdalena district a shoot of high-grade gold ore has been encountered in the midst of the large deposits of low-grade ore being worked. A winze on the new strike is down 20 ft. The mill, which has been shut down for some time owing to a breakdown, will be ready to drop stamps again in about two weeks.

Metal, Mineral, Coal and Stock Markets

Current Prices, Market Conditions and Commercial Statistics of the Metals, Minerals and Mining Stocks

QUOTATIONS FROM IMPORTANT CENTERS

Coal Trade Review

New York, Feb. 24—The coal trade in the East continues on about the same level as by our last report. No special activity has developed, although in some sections there is rather steadier demand for coal, but not enough to affect the market to any considerable degree. In the interior bituminous-coal trade a somewhat greater demand for steam coal is beginning to develop, although progress is slow.

In the anthracite trade the main topic of discussion is the probability of a strike in April. While no public announcement has been made, it is generally accepted as certain that the anthracite-coal companies will not open discussion of the disputed questions with the representatives of the Miners' union, thereby rejecting at the outset the principal demand of the union. The other points raised about wages and minor details could probably be adjusted without much difficulty, but the companies seem determined to insist upon the open-shop principle. They are also opposed to the abolition of the conciliation board and to the limit of the agreement to one year. It is quite probable that they have accepted the present as a good time to try conclusions with the union. They have accumulated stocks of the domestic sizes of coal sufficient to carry them for some time, although the small steam sizes would probably run short very quickly.

In the West the coal trade is quiet, with a moderate increase in domestic trade owing to the prevalence of colder weather. The steam-coal trade shows very little variation except that several large concerns have shown considerable interest in yearly contracts and some of encouraging amount have been closed.

The coke business is showing a decided improvement and shipments over the various railroads have increased considerably since the beginning of the year.

Coal Traffic Notes

Tonnage originating on Pennsylvania railroad lines east of Pittsburg and Erie, year to Feb. 13, short tons:

	1908.	1909.	Changes.
Anthracite	658,927	598,696	D. 60,231
Bituminous	3,938,680	4,152,129	I. 213,449
Coke	875,939	1,205,309	I. 329,370
Total	5,473,546	5,956,134	I. 482,588

The total increase this year to date was 8.8 per cent.

New York

Anthracite

Feb. 24—Business continues quiet with no change in prices. The weather has not been cold enough to cause any increase in demand even in a retail way. Temporarily there is rather a scarcity of the small steam sizes. This is owing to the fact that operations at many of the larger collieries have been curtailed and in consequence less steam coal is made. Moreover, some consumers of the small sizes have been putting in stocks ahead in order to provide for a possible stoppage of mining, thus increasing the demand at a time when the supply was not over abundant.

Prices are unchanged. The list prices for prepared sizes are $4.75 for broken, and $5 for egg, stove and chestnut. Small steam sizes are: Pea, $3.25@3.50; buckwheat No. 1, $2.35@2.50; buckwheat No. 2 or rice, $1.60@2; barley, $1.35@1.50; all f.o.b. New York harbor points.

Bituminous

The soft-coal market continues quiet, although the aggregate quantity of coal handled is large, as it always is even in dull times. Contracts are still being talked about, but very few have been closed. The prices offered—and in some cases accepted—are lower than last year, but in most cases better than the current market.

Trade in the far East is dead and no coal is being taken for that section. Along the Sound there is some buying and it may be noted that this is steadier than it was recently. New York harbor is still dull, though some coal is being taken and consumers are showing a little more interest.

Prices show no material change. In New York harbor good grades of steam coal are selling at $2.40@2.50, f.o.b. harbor shipping port, while lower grades can be had at $2.20@2.30 per ton.

All-rail trade is better than tidewater and the interior cities are taking a fair amount of coal. Car supply is abundant and transportation good, with very few delays.

The Coastwise market is dull and vessels are still looking for charters. There is no change in freight rates, those quoted for large vessels from Philadelphia being: Boston, Salem and Portland, 75c.; Lynn and Bath, 85c.; Portsmouth, 80c.; Newburyport, 95c.; Providence, New Bedford and the Sound, 65@70c. per ton.

Birmingham

Feb. 22—Further curtailment in production is noted in the coal-mining section of Alabama, several mines being closed down now or running on half time and less. There is no demand for coal. The larger furnace companies have stacked up enough coke to warrant a cessation at several batteries of coke ovens. There is but little domestic demand for coal. Prices are beginning to descend, but this does not bring about any business. The mining concerns do not look for any immediate improvement in the general conditions.

Chicago

Feb. 22—The coal market continues fairly strong, for both steam and domestic coals. Not only is the demand somewhat better, but the market is lightened by lighter shipments. Weather conditions have not been such as to predicate continuance of the existing conditions, however, and the coming week, with mild temperatures over Chicago territory indicated, will probably see a slack demand. Buying is so responsive to changes in temperature, for domestic coals, that consumers and dealers appear generally to have small supplies. Steam coals are evidently being bought close to current needs, and there is no apparent increase in these needs. The industrial situation, however, is bettering slowly. Eastern coals have improved in tone in this market, and smokeless is notably improved owing to lessened shipments, though still in large supply and with prices on run-of-mine 15@25c. under circular prices.

Illinois and Indiana coals bring, in car lots, $1.80@2.40 for lump, $1.60@1.75 for run-of-mine and $1.30@1.60 for slack. Smokeless sells at $2.75@3.15 for Pocahontas and New River run-of-mine, and $3.15@3.45 for lump or egg. Hocking is in much better condition, the demand being large and the supply not curtailed so as to remove demurrage sales, holding the price up close to $3.15, circular quotation. Eastern gas coals have a light but steady demand with stationary prices. Anthracite continues to have a good run of sales for small lots, but well distributed.

Cleveland

Feb. 23—The demand for domestic coal resulting from the weather still gives some activity to the market, though it is gradually falling off. Steam coal is in moderate demand, the tendency still being to buy slack rather than run-of-mine or lump. There is not much demurrage coal in evidence here, to depress prices.

Discussion of Lake rates is in order, but very little has been done so far. Much depends on the demand for iron ore and the number of ore boats going back light and ready to take coal cargoes.

Pittsburg

Feb. 23—There has been no change in operations during the week, production in the Pittsburg district being at the rate of about 35 per cent. of capacity of the mines. Prices are being firmly held at $1.15 a ton for mine-run coal at mine. Slack is quoted at 65c. The rivers were navigable the last few days of the week and fully 2,000,000 bu. coal went to lower ports, almost cleaning up the accumulated stocks in the pools and harbor. There are plenty of empty coal boats and barges here and all the river mines are in operation and will be kept going steadily.

Connellsville Coke—The coke trade continues dull and prices are weaker. Production has not been curtailed to a great extent. Large producers who had endeavored to maintain prices on foundry coke have made a reduction. Foundry coke for delivery in the second half is quoted at $2@2.15 and for spot shipment $2 is the lowest price named. Furnace coke is held at $1.75 for spot and $1.90 on contract but it is possible to shade these prices. The *Courier* gives the production of coke in both of the Connellsville fields at 268,958 tons. Shipments amounted to 9643 cars as follows: To Pittsburg district, 3490; to points west of Pittsburg, 5516; to points east of Connellsville, 637 cars.

Foreign Coal Trade

Nova Scotia Coal—Shipments of coal from Nova Scotia mines in January are reported as follows, in long tons:

	1908.	1909.	Changes.	
Dominion	202,063	120,130	D.	81,933
Nova Scotia Steel	38,845	47,750	I.	8,905
Cumberland	27,015	27,294	I.	279
Acadia	29,433	24,852	D.	4,581
Inverness	.....	.....		.....
Intercolonial	24,948	19,767	D.	5,181
Total	322,304	239,793	D.	82,511

No report for the month received from the Inverness Coal Company. Total decrease this year, 25.6 per cent.

British Coal Exports—Coal exports from Great Britain, with coal sent abroad for use of steamers in foreign trade, for the month of January, long tons:

	1908.	1909.	Changes.	
Coal	4,677,800	4,308,635	D.	369,165
Coke	108,506	75,761	D.	32,745
Briquets	132,324	110,108	D.	22,216
Total exports	4,918,630	4,494,504	D.	424,126
Steamer coal	1,608,253	1,500,743	D.	107,510
Total	6,526,883	5,995,247	D.	531,636

The larger exports this year were 803,725 tons to France, 712,891 to Italy, and 468,902 to Germany. Exports to the United States were 1158 tons.

Belgian Coal Production—The production of coal in Belgium for the full year was 23,824,499 metric tons in 1907, and 23,678,150 in 1908; a decrease of 146,349 tons. Unsold stocks on Dec. 31, 1908, were 917,330 tons, an increase of 475,712 tons over the previous year.

Welsh Coal Prices—Messrs. Hull, Blyth & Co., London and Cardiff, report current prices of coal as follows, on Feb. 13; Best Welsh steam, $3.36; seconds, $3.24; thirds, $3.12; dry coals, $3.48; best Monmouthshire, $3.06; seconds, $2.94; best small steam, $2.10; seconds, $1.80. All per long ton, f.o.b. shipping port.

Iron Trade Review

New York, Feb. 24—The iron and steel trades have shown a marked contrast to the inactivity of recent weeks. In our last report we mention that a general meeting of the steel trade had been held in New York and stated that reductions in prices were almost certain to follow. The announcement did, in fact, come two days later, but instead of taking the form of a new schedule of prices put out by the leading interest, it was announced that Steel Corporation agents had received orders to meet the cuts made recently by independent manufacturers and if necessary to go below them. This left the market an open one, with the assurance that the leading interest would not hold back, but would make such concessions as might be necessary to secure business.

Under the new order sales are reported at prices which imply a cut of from $6 to $8 per ton in plates, $4 in steel bars and at least $7 in structural steel. Bars had previously been rather demoralized and both iron and steel bars are now selling at around 1.20c. at mill, with some sales reported at 1.15c. and even 1.10c. is talked about. As to the extent of these sales it is difficult to make an estimate. Many reports are current and the market has hardly had time enough to adjust itself to the new conditions. One important point is that a number of contracts for buildings which have been held back for some time are being rushed forward, to take advantage of the lower prices of material now possible. In another week, probably, the real effect of the reduction will be manifest. The general belief is that a large amount of business will be placed.

One important point is that under the new orders two basing points have been adopted, rates being made on the basis of Chicago delivery as well as at Pittsburg. Whether this is intended to be permanent or not has not been stated. Probably it will be so and will refer to delivery from the Gary works as well as Chicago.

Steel rails were not included in the order for reduction and it is understood that prices are a subject of conference among the rail makers. It has been reported that one or two rail mills have made tentative offers to sell heavy sections at $25, but this cannot be confirmed.

Upon the whole—while as we have said, it is still difficult to appreciate the full effect upon the market—the indications are that a considerable revival in business may be expected and that consumers will take more interest than they have done for some time past, when they appreciate that their views on prices are being met, and that considerable economies can be secured by purchasing material at the present time.

There has been some improvement in the demand for pig iron. Furnaces generally appear to be ready to make concessions except on special brands. Southern pig iron has been cut from $13 to $12.50 Birmingham for No. 2 foundry and some sales are reported at even lower prices. Other concessions will probably follow.

It is intimated in many quarters that reductions in prices will probably be followed by equal reductions in wages. This is altogether probable and many such reductions will be made, though not perhaps immediately. In fact, wages in some important branches of the trade are governed by agreements which still have some time to run and which cannot be changed at once.

Baltimore

Exports for the week included 195,110 lb. spelter, 112,000 lb. lead and 3,051,000 lb. steel billets to Great Britain; 4773 tons steel rails to Panama; 758 tons steel rails and 352 tons track material to Mexico. Imports for the week included 1131 tons spiegeleisen, 1859 tons ferromanganese and 185 tons ferrosilicon from Germany; 4950 tons iron ore from Cuba.

Birminghan

Feb. 22—The pig-iron market in the Southern territory is dull. The sales being made just now are in small lots and the aggregate far from being satisfactory. A reduction in quotations has been made, No. 2 foundry being quoted at $12.50 per ton, against $13, which has prevailed for some time. There are no concessions being made on the $12.50 per ton rate, reports to the contrary notwithstanding. The Alabama Consolidated Coal and Iron Company during the past week announced the sale of 2500 tons of Clifton iron to the American Locomotive Company on a basis of $12.50 per ton, No. 2 foundry, immediate delivery practically stipulated. The shipments in the Southern territory are still quite steady though there is no telling when a change will be noted. Reports received here are to the effect that a number of consumers have very little iron on hand but are in no hurry to lay in stocks. The Southern cast-iron pipe con-

cerns have been a help to the manufacturers of pig iron; they are working hard and have orders in hand and in sight that will keep them busy for some time to come. There has been no curtailment in the pig-iron production in the Southern territory as yet, though the same is again under consideration. There is a half-way belief expressed that the change for the better will be noted just after the turn of the new month. There is no iron accufulating in this district, old orders on hand requiring steady shipments and the melt by the pipe plants being good. No change in conditions is noted at the steel plants. The general understanding here is that if there is no improvement in conditions the Ensley plant may be shut down.

Chicago

Feb. 22—The iron market continues unmarked by any significant changes. There is a fair sale of pig iron in small lots, for delivery almost wholly within the next 30 to 90 days, with everybody awaiting general developments of business. Northern No. 2 is nominally quoted at $17@17.50, and Southern No. 2 at $13 Birmingham, or $17.35 Chicago, but cuts of 25 and 50c. prevail, and some lots may bring still less. The market has no fixed prices on any considerable amount of iron.

That the Steel Corporation's reduced prices on its products will do much to stimulate business locally seems to be the sentiment of the market. In the last week as heretofore for several weeks, business in iron and steel products has been quiet. The average melter of pig iron has undoubtedly been conservative about purchases through a variety of causes, chief of which have been tariff agitation and slowness of the country to increase consumptive power. Consumption of iron, though not large, has been fairly steady and remains so. For the future there are a few inquiries for lots of good size and occasionally a sale is made, but furnace agents profess not to be anxious for much business at prices which appeal to melters. Coke continues in light to moderate demand, at $4.85 for the best Connellsville.

Cleveland

Feb. 23—There is no change in the ore situation. Shipments from docks are light, furnaces being reluctant to put in stocks in the present condition of the pig-iron market. Ore sellers are not doing anything about prices, as they believe that any buying movement this season will come late.

A few contracts have been made for season ore shipments at the rates which prevailed last year: 65c. from the head of the Lakes to Lake Erie ports; 60c. from Marquette, and 50c. from Escanaba.

Pig iron is dull, sales being small, while the inquiries received are of the tentative order entirely. The market is still based upon $16.25@16.50 Cleveland, for No. 2 foundry.

Finished material is dull, buyers being, apparently, still at sea on the question of the new reductions in prices.

Philadelphia

Feb. 24—Several transactions in pipe and foundry iron which have been hanging fire since the first of the month will probably terminate in definite orders by the close of the week for Pennsylvania pig irons, because of concessions made by makers. In a general way, very little business is being done. Consumers are mostly low in stocks. They are daily looking for a general concession in prices. A few of the stronger companies prefer to pile iron than lower prices. Somewhat greater activity prevails in the foundries and machine shops. Apart from the general disturbance in the steel trade, conditions are improving and consumers talk in a more hopeful spirit. A few small sales of forge just made show that prices are receding. No. 1 foundry alone holds up well. Basic has undergone a relapse.

Structural Material—The business has consisted mainly of extensions or additions to former contracts. The sharp reductions have not yet been followed by heavy ordering. The market is in a serious condition and a great deal is going on beneath the surface that does not find its way into print.

Scrap—Dealers report very little activity. Some railroad companies are parting with scrap on terms which they refused a few weeks ago. In light scrap a drop of 50c. is noted without much selling.

Pittsburg

Feb. 23—The readjustment in steel prices referred to in last report was decided upon at a meeting held Feb. 18, the form being that of declaring an open market on all steel products, with the exception of standard rails. Each manufacturer was allowed to quote any price desired, and was free to reduce his prices if lower prices should be developed. There had been considerable shading in various products and it was felt that the producers who were disposed to shade would continue to do so as long as any large interests held the umbrella; so that it would be best to put the umbrella away and let it be understood that any cut prices made would be met promptly.

The open market began Feb. 19 and since then the work has been that of developing prices. This work is not half through yet, some lines not having shown any new prices at all, while in others it is not settled that the new prices will hold. There are prospects, however, that they will. The market developments thus far are summarized below.

Plates and shapes, on which the official price had been 1.60c., but which had been shaded more or less for months, were first quoted at 1.40c., by some large interests, but as somewhat lower prices were named by some, a price of 1.30c. was promptly put out, and this has held. Merchant-steel bars, which had been officially 1.40c., with an inside price to large jobbers and some others of 1.35c., have settled at 1.20c., with no concession. This price has held, although there has been strenuous complaint on the part of large jobbers who have been accustomed to buying at $1 a ton under the open market. On Feb. 22 the National Tube Company announced to its customers a new list on steel pipe, five points or about $10 a net ton under the old list, making the official discount on "jobbers' carloads" 80 per cent. off list, against 75 per cent. off list. The trade custom has been to allow large consumers an extra half point, and large jobbers one point, with an extra 5 per cent. This makes the new inside price to jobbers in large lots 81 and 5 per cent. off list. The American Sheet and Tin Plate Company, while making no open announcement, decided to hold to former prices on sheets and tinplates, at least for the present. The American Steel and Wire Company announced this morning that on March 1 it would issue a new list of prices, and would adjust prices on all shipments of Feb. 19 and later according to the new list. Billets, sheet-bars and wire-rods have not been touched, absolutely no developments having occurred. Nothing has been done yet in iron products, such as bars and pipe. It is probable that iron pipe will be reduced by about the same amount as steel pipe, keeping it at about the same differential as formerly above steel pipe, this having been two points lately.

There have been no sales of consequence at the new prices. There was no large business hanging over the market, and the new prices have not been tested seriously. Indeed, they have been arrived at largely for the purpose of finding a basis upon which to adjust undelivered tonnages. All shipments made Feb. 19 and later are to be adjusted to new prices as developed, with the exception that a stand has been taken that when the material is for a definite job, on which the contractor's price has already been fixed, no concession should be given.

It is expected that as soon as the adjustment is completed there will be business placed which has been backing up, while in the course of two or three months there will be further improvement in tonnage, and that the second half of this year will show about as large a tonnage as in previous active years.

It is generally accepted that salaries and wages will be reduced, but no definite move is to be made until the full extent

of the price readjustment has been made known.

Pig Iron—The market has been stagnant, the readjustment in steel putting a final quietus upon any disposition to do business. In the pig-iron trade the opinion is strongly expressed that the present developments should help pig iron, by stimulating tonnage, but against this is the prospect that Lake Superior ore will come down. The ore interests insist that no consideration has been given to this subject, and in any event it is quite improbable that they would put out new prices for June, or perhaps July 1. Quoted prices are lower by 50c. in bessemer and by 25c. in basic, foundry and forge being nominally unchanged. We quote, f.o.b. Valley furnace: Bessemer, $15.50; basic, $15; No. 2 foundry, $15; malleable, $15.50; gray forge, $14.25.

Ferro-Manganese—The market is entirely nominal at last quotations, $45.50@46, Pittsburg.

Metal Market

New York, Feb. 24—The metal markets are still in a depressed and rather uncertain condition. Lower prices seem to be the rule in almost all directions.

Gold, Silver and Platinum

UNITED STATES GOLD AND SILVER MOVEMENT

Metal.	Exports.	Imports.	Excess.
Gold:			
Jan. 1909..	$ 7,865,196	$ 3,412,583	Exp. $4,452,613
" 1908..	444,200	10,799,484	Imp. 10,355,284
Year 1909..	7,865,196	3,412,583	Exp. 4,452,613
" 1908..	444,200	10,799,484	Imp. 10,355,284
Silver:			
Jan. 1909..	4,542,254	3,660,052	Exp. 882,202
" 1908..	4,148,144	3,621,874	" 526,270
Year 1909..	4,542,254	3,660,052	" 882,202
" 1908..	4,148,144	3,621,874	" 526,270

Exports from the port of New York, week ended Feb. 20: Gold, $1,217,000, chiefly to Argentina; silver, $1,062,615, to London and Paris. Imports: Gold, $197,961, from Japan, the West Indies and South America; silver, $81,642, from Mexico and Panama.

Foreign commerce of the United States, month of January, reported by Bureau of Statistics, Department of Commerce and Labor:

Merchandise:	1908.	1909.
Exports	$ 206,114,718	$ 156,767,714
Imports	84,997,514	103,524,028
Excess, exports	$ 121,117,204	$ 53,243,686
Add excess of exports, silver		882,202
Add excess of exports, gold		4,452,613
Total export balance		$ 58,578,501

The gold and silver movement in detail will be found in the table at the head of this column.

Gold—The price of gold on the open market in London has been unchanged at 77s. 9d. for bars; 76s. 4d. per ounce for American eagles. The Bank of England continues to take most of the gold arriving. The Bank of France is out of the market still. In New York there was some gold shipped to Argentina on London account, but none to Europe.

Platinum—Prices are unchanged, dealers asking $23.50@24.50 for refined platinum, $26 for hard metal and $19@21 for scrap. Business is quiet with demand running rather light.

Silver—The silver market was depressed by some speculative selling—chiefly China sales—and moderate buying only from other quarters. The price is fairly steady at the decline.

SILVER AND STERLING EXCHANGE

Feb.	18	19	20	22	23	24
New York....	51⅛	50¾	50¾	.....	50⅝	50⅞
London.....	23 1/16	23 1/16	23 7/16	23 1/16	23 1/16	23 1/16
Sterling Ex..	4.8705	4.8715	4.8735	.....	4.8750	4.8735

New York quotations, cents per ounce troy, fine silver; London, pence per ounce sterling silver, 0.925 fine.

Shiments of silver from London to the East, year to Feb. 11, reported by Messrs. Pixley & Abell, London:

	1908.	1909.	Changes.
India.....	£ 866,188	£ 529,560	D. £ 336,628
China.....	451,400	80,000	D. 371,400
Straits.....	.....	61,000	I. 61,000
Total.....	£ 1,317,588	£ 670,560	D. £ 647,028

Imports for the week, £3500 from Mexico, £6000 from the West Indies and £185,000 from New York; total, £194,500. Exports, £31,500 coin to the Straits, and £52,000 bars to India; £83,500 in all.

Copper, Tin, Lead and Zinc

Feb.	Copper. Lake, Cts. per lb.	Copper. Electrolytic, Cts. per lb.	Copper. London, £ per ton.	Tin. Cts. per lb.	Lead. New York, Cts. per lb.	Lead. St. Louis, Cts. per lb.	Zinc. St. Louis, Cts. per lb.
18	13 @13¼	12¾ @13	57 1/16	28½	4.00 @4.02½	3.85 @3.87½	4.67½ @4.72½
19	12¾ @13	12⅝ @12⅞	57	28¼	3.97½ @4.00	3.82½ @3.85	4.65 @4.70
20	12¾ @13	12⅝ @12¾	....	28½	3.97½ @4.00	3.82½ @3.85	4.65 @4.70
22	.....	.....	....	....	.....	.....	.....
23	12¾ @13	12½ @12⅝	56¼	29	3.95 @4.00	3.80 @3.85	4.62½ @4.67½
24	12¾ @13	12¾ @12⅝	56⅜	28¾	3.95 @4.00	3.80 @3.85	4.60 @4.65

NOTE—Spelter prices given are at St. Louis; New York quotations, Feb. 18-24, were 0.15c. higher than St. Louis.

London quotations are per long ton (2240 lb.) standard copper. The New York quotations for electrolytic copper are for cakes, ingots and wirebars, and represent the bulk of the transactions made with consumers, basis, New York, cash. The price of cathodes is usually 0.125c. below that of electrolytic. The quotations for lead represent wholesale transactions in the open market. The quotations on spelter are for ordinary Western brands; special brands command a premium.

Copper—The market has been bordering on demoralization throughout the week. By making radical concessions some lots of copper have found a market in Europe. Home consumers so far are entirely indifferent to the lower prices that have been established; on the one hand, their business has suffered, and on the other, they are apprehensive of a further decline because they believe that such will be necessary to market the accumulations. The close is weak at 12¾@13c. for Lake copper; 12⅜@12⅝c. for electrolytic in ingots, cakes and wirebars. The average of the week for casting copper has been 12½@12⅝c., the price being 12⅜c. at the close.

Copper sheets are lower, 17.3@17.5c. for cold-rolled, large lots; 16.5c. for hot-rolled. Copper wire, 15¼c. base, carload lots at mill.

The market in London for speculative sorts declined rapidly the early part of the week, but since Monday it has held relatively steady, the close being cabled at £56 7s. 6d. for spot, £57 2s. 6d. for three months.

Refined and manufactured sorts we quote: English tough, £60 10s.; best selected, £59 10s.@£60 10s.; strong sheets, £71 10s.@£72 10s.

Tin—The London market has had a rather sharp advance during the last few days. There was a good deal of speculative buying, brought about no doubt by advices of shipments from the Straits which indicate a falling off for February and March. The close is somewhat softer at £129 10s. for spot, £131 for three months.

While not much business has been done in the domestic market, prices have followed closely the advance in London and dealers are asking 28¾c. for spot metal at the close.

Tin production of the Federated Malay States in January was 4213 long tons; a decrease of 1322 tons, as compared with January of last year.

Lead—Prices have declined further, and on Feb. 24 the American Smelting and Refining Company recognized the situation by reducing its figure to 4c. New York. The market closes weak at 3.80@3.85c. St. Louis, 3.95@4c. New York.

The London market has been well supported throughout the week and the close is steady at £13 10s. for Spanish lead, £13 12s. 6d. for English lead.

Spelter—Business has been of small proportions and whatever orders come into the market are eagerly competed for. The reductions in the price of iron and steel have so far not increased the demand from galvanizers. The close is weak and lower at 4.60@4.65c. St. Louis, 4.75@4.80c. New York.

Smelters in Kansas and Oklahoma are generally restricting their output by putting furnaces on dead-fire.

The London market is firmer, the close being cabled at £21 15s. for good ordinaries, £22 for specials.

Base price of sheet zinc is 7c., f.o.b. La Salle-Peru, Ill., less 8 per cent.

Other Metals

Antimony—No business is being done, and the market is at a standstill. In the absence of sales prices are nominally unchanged, and we quote 8⅛c. per lb. for Cookson's; 8c. for Hallett's; 7⅞@7⅝c. for ordinary brands.

Aluminum—Business is quiet, with no new developments. Foreign metal is still offered at 22c., New York, but no sales are reported. The Aluminum Company of America quotes 24c. base for No. 1 ingots; 33@34c. base for sheets.

Quicksilver—Business continues small in volume. New York quotations are unchanged at $45@46 per flask of 75 lb. San Francisco quotations are nominal at $45@46 for domestic business and $43@44 for export. The London price is £8 7s. 6d. per flask, but down to £8 5s. is quoted by jobbers.

Nickel—Large lots, contract business, 40@45c. per lb. Retail, from 50c. for 2000-lb. lots up to 55c. for 500-lb. lots. These quotations are for spot nickel. The price for electrolytic is 5c. higher.

British Metal Imports and Exports

Imports and exports of metals in Great Britain, month of January, figures in long tons, except quicksilver, which is in pounds:

	Imports.	Exports.	Excess.	
Copper	12,842	6,089	Imp.	6,753
Copper, 1908	12,212	5,543	Imp.	6,669
Tin	3,564	2,067	Imp.	1,497
Tin, 1908	3,381	2,371	Imp.	1,010
Lead	18,613	2,765	Imp.	15,848
Lead, 1908	19,034	4,955	Imp.	14,079
Spelter	9,359	490	Imp.	8,869
Spelter, 1908	7,664	459	Imp.	7,205
Quicksilver, lb.	9,992	60,746	Exp.	50,754
Quicksilver, '08	18,375	234,055	Exp.	215,680
Ores:				
Tin ore and con.	1,305	.....	Imp.	1,305
Tin ore, 1908	2,005	.....	Imp.	2,005
Pyrites	64,636	.....	Imp.	64,636
Pyrites, 1908	97,073	.....	Imp.	97,073

Copper totals include metallic contents of ore and matte. Exports include re-exports of foreign material. Of the imports in 1909 the United States furnished 15 tons copper matte, 1596 tons fine copper, and 2746 tons lead.

Zinc and Lead Ore Markets

Joplin, Mo., Feb. 20—The highest price paid for zinc sulphide ore was $40 per ton, the base price ranging from $35 to $38 per ton of 60 per cent. zinc, stronger at the week-end—$36@38, with increased demand for all grades. Zinc silicate sold at $26 top, on a base of $19@22 per ton of 40 per cent. zinc. The average price, all grades of zinc, was $34.72. Lead opened weak at $50, declining to $49 and $48, with a falling demand, much of the ore shipped being from previous purchases.

The weather is admirable for outputting for the season, and the mine owners are again adjusting the wage scale and expense account to the market conditions, saving a panicky margin of profits to some, while others are merely trading even.

SHIPMENTS, WEEK ENDED FEB. 20

	Zinc, lb.	Lead, lb.	Value.
Webb City-Carterville	3,826,660	1,327,640	$102,069
Joplin	1,789,960	264,300	38,844
Galena	961,920	49,460	18,524
Duenweg	780,750	21,540	13,434
Alba-Neck	674,530	.....	12,478
Badger	655,590	.....	12,128
Prosperity	416,400	150,630	11,260
Miami	431,710	189,790	10,166
Spurgeon	470,690	102,000	9,606
Carthage	339,460	.....	6,097
Granby	364,000	5,500	5,049
Aurora	357,850	.....	4,777
Cave Springs	220,190	.....	4,184
Zincite	154,010	.....	2,772
Seneca	.....	48,190	1,156
Sarcoxie	59,650	.....	656
Everton	41,300	.....	414
Totals	11,544,710	2,139,050	$253,614
Eight weeks	84,524,190	13,550,750	$1,899,133

Zinc value, the week, $200,457; 8 weeks, $1,550,074
Lead value, the week, 53,157; 8 weeks, 349,059

MONTHLY AVERAGE PRICES

Month.	Zinc Ore. Base Price.		Zinc Ore. All Ores.		Lead Ore. All Ores.	
	1908.	1909.	1908.	1909.	1908.	1909.
January	$37.60	$41.25	$35.56	$38.46	$46.88	$52.17
February	36.63	.....	34.92	.....	49.72	.....
March	36.19	.....	34.19	.....	49.90	.....
April	35.40	.....	34.08	.....	52.47	.....
May	34.19	.....	33.39	.....	56.05	.....
June	33.06	.....	32.07	.....	60.48	.....
July	34.55	.....	31.67	.....	59.90	.....
August	36.53	.....	33.42	.....	60.34	.....
September	37.63	.....	34.44	.....	54.59	.....
October	35.95	.....	33.28	.....	52.63	.....
November	39.13	.....	35.02	.....	54.53	.....
December	42.75	.....	39.63	.....	49.68	.....
Year	$36.63	.....	$34.31	.....	$53.93	.....

NOTE—Under zinc ore the first two columns give base prices for 60 per cent. zinc ore; the second two the average for all ores sold. Lead ore prices are the average for all ores sold.

Platteville, Wis., Feb. 20—The highest price paid for zinc ore this week was $38 per ton; the base price for 60 per cent. zinc was $36@37 per ton. There was less than the usual amount of high-grade ore available for competitive purchase, a number of roasting plants being idle. One car of lead ore brought $48 per ton; the base price for 80 per cent. lead was $46 per ton.

SHIPMENTS, WEEK ENDED FEB. 20

Camps.	Zinc ore, lb.	Lead ore, lb.	Sulphur ore, lb.
Cuba City	386,855	75,240	74,600
Hazel Green	363,400	.....	.....
Strawbridge	352,000	.....	.....
Platteville	286,415	.....	.....
Linden	253,180	.....	.....
Livingston	190,000	.....	.....
Benton	170,500	.....	.....
Rewey	65,390	.....	.....
Harker	34,900	.....	.....
Total	2,102,640	75,240	74,600
Year to Feb. 20	16,141,466	521,240	1,390,200

In addition to the above there was shipped to the American Zinc Ore Separating Company from Rewey, 324,460 lb.; from Benton, 267,800 lb.; from Lancaster, 92,000 lb.; from Platteville, 168,820 lb. Shipped to the Joplin Separator Works, from Hazel Green, 305,400 lb.; from Linden, 76,670 lb. zinc ore.

Chemicals

New York, Feb. 24—Business continues quiet, and the situation is not changed. The general tendency seems to be to buy for immediate use only.

Copper Sulphate—Only a moderate business has been transacted. Prices remain, however, the same as last week at $4.60 per 100 lb. for carload lots and over; $4.85@5 per 100 lb. for smaller parcels.

Nitrate of Soda—Trade remains easy. Prices are unchanged, spot nitrate being quoted at 2.15c.; for future business, 2.12½c. is asked.

Mining Stocks

New York, Feb. 24—The reduction in steel prices—which in the true light is really a bull argument—was taken up by the bears as a reason for forcing a general reduction. Beginning with United States Steel a sharp decline set in, which involved not only the industrials, but also Amalgamated Copper and finally many railroad stocks. The market was generally excited after the holiday on Monday, and on Tuesday the dealings were the heaviest of the year. The quotations were lower all around at the close, with the market still tending downward, and indications of a bear market likely to last for a time, with occasional rallies possible.

The Curb followed the course of the Stock Exchange, with general declines in quotations, some of a sharp order. There was, however, a degree of conservatism not always shown on the Curb. The copper stocks generally were heavy and rather weak, with much selling and a good deal of liquidation. In other mining stocks trading was not so heavy, but there was a general downward tendency manifest. The close did not point to an immediate recovery.

Boston, Feb. 23—Mining-share prices are the lowest of the year and considerably below the high levels of 1908. Each day the past week has seen lower prices, as a rule. Certain stocks have had their ups and downs and periods of activity, but prices are considerably off in the week's time. This is due to the fact that copper has weakened and the cut in the prices of steel products has had a depressing effect also.

Even the knowledge that A. S. Bigelow and associates will deliver to the Calumet & Hecla people this week something like 125,000 shares in the Osceola, Tamarack, Ahmeek, Isle Royale, Seneca and Laurium mining companies, could not stem the tide in today's selling and liquidation.

Calumet & Hecla directors have de-

clared a quarterly dividend of $5, the same as the four previous payments. The stock is off $20 net to $625. North Butte has gone off $9 in the week to $66.50 on persistent offerings of stock. Amalgamated has lost $7.50 to $68.75; Copper Range $4.75 to $71.25; Mohawk $5 to $60; Old Dominion $4 to $48; Quincy $4 to $88; Superior $3 to $41.75, and Utah Consolidated $2.87½ to $39. Dominion Iron and Steel touched $38.50, but is back to $30. Trinity broke $3.62½ to $12 on announcement that ore shipments to the Balaklala smelter had ceased on account of the low price of copper.

Isle Royale spurted to $33, but is off to $28.50. Osceola touched $138, but closed $8 below this tonight. La Salle has lost $1.75 to $15; Lake $2.62½ to $17; Tamarack $7.50 to $79.50; Allouez $3 to $41.

Old Dominion directors have declared the usual quarterly dividend of 50c. East Butte has been a strong feature, advancing to $14.25, but was off to $12.75 tonight. Boston Consolidated has been weak and fell to $11.50. This company will issue 50,000 shares, at tonight's closing price, making the total outstanding, 775,000 shares. The issue has been underwritten. The Victoria opposition to the present management appeared at the meeting today but the election was adjourned for the following day.

The Curb has been active and prices are slightly lower. Trading in Southwestern Development has been ordered to cease on the Curb temporarily.

STOCK QUOTATIONS

NEW YORK Feb. 23	
Name of Comp.	Clg.
Alaska Mine	.36
Amalgamated	68½
Anaconda	40
Balaklala	‡2 1/16
British Col. Cop.	6¾
Buffalo Mines	3⅛
Butte Coalition	22½
Colonial Silver	7 1/16
Cum. Ely Mining	7¾
Davis Daly	3 1/16
Dominion Cop	3½
Douglas Copper	3
El Rayo	3½
Florence	3 1/16
Foster Cobalt	‡.56
Furnace Creek	.11
Giroux	6⅞
Gold Hill	⅜
Goldfield Con	7⅛
Granby	97
Greene Gold	¾
Greene G. & S.	7
Guanajuato	‡1¾
Guggen. Exp	181
Hanapah	.15
Kerr Lake	8
McKinley Dar.	.93
Miami Copper	13⅛
Micmac	1¾
Mines Co. of Am.	⅞
Mitchell Mining	‡⅛
Mont. Sho. C.	2½
Nev. Utah M. & S.	2 1/16
Newhouse M. & S.	4⅜
Nipissing Mines	9¾
Old Hundred	‡1 1/16
Silver Queen	.65
Stewart	1/16
Tennessee Cop'r	37¼
Tri-Bullion	1
Union Copper	1 1/16
Utah Apex	6 1/16
Utah Copper	40⅛
Yukon Gold	4⅛

BOSTON Feb. 23	
Name of Comp.	Clg.
Adventure	7¾
Allouez	41
Am. Zinc	‡26½
Arcadian	4¼
Arizona Com	32½
Atlantic	15¼
Boston Con	11½
Calumet & Ariz.	99
Calumet & Hecla	625
Centennial	31
Con. Mercur	.30
Copper Range	71½
Daly-West	10
East Butte	12⅞
Franklin	13¾
Greene—Can	10
Isle Royal	28½
La Salle	15
Mass	5¼
Michigan	11
Mohawk	60
Nevada	17
North Butte	66¾
Old Colony	.60
Old Dominion	48
Osceola	130
Parrot	27
Quincy	88
Rhode Island	‡¾
Santa Fe	2⅛
Shannon	14
Superior	41½
Superior & Pitts.	14⅜
Tamarack	80
Trinity	12½
United Cop., com.	12
U. S. Oil	30⅜
U. S. Smg. & Ref.	40⅛
U.S. Sm. & Re., pd.	44⅞
Utah Con	39
Victoria	5
Winona	5⅛
Wolverine	145
Wyandotte	2⅝

*Ex. Div. †Ex. Rights. ‡Last quotation.

N. Y. INDUSTRIAL	
Am. Agri. Chem.	35¼
Am. Smelt. & Ref.	80⅛
Am. Sm. & Ref. pf.	101
Colo. Fuel & Iron	29
Federal M. & S., pf.	‡84
National Lead	73
National Lead, pf.	‡108¾
Pittsburg Coal	‡11⅞
Republic I. & S.	16¾
Republic I. & S., pf.	67⅛
Sloss-Sheffield	68¾
Standard Oil	636
U. S. Steel	41⅛
U. S. Steel, pf.	107
Va. Car. Chem	41⅝

BOSTON CURB	
Ahmeek	165
Black Mt.	2¾
Chemung	20½
Globe Con	5⅝
Hancock	12⅛
Helvetia	3½
Keweenaw	‡4¾
North Lake	‡7⅛
Ojibway	13
Superior & Bost.	‡16¾

Furnished by Hornblower & Weeks, N. Y.

ST. LOUIS Feb. 20		
N. of Com.	High.	Low.
Adams	.40	.30
Am. Nettie	.07	.03
Center Cr'k	1.90	1.40
Cent. C. & C.	78.00	77.00
C.C. & C. pd.	80.00	79.00
Cent. Oil	105.00	100.00
Columbia	8.00	5.00
Con. Coal	20.00	19.00
Doe Run	110.00	105.00
Gra. Bimet.	.25	.17
St. Joe	12.00	11.00

LONDON Feb. 24	
Name of Com.	Clg.
Dolores	£1 10s 0d
Stratton'sInd.	0 3 3
Camp Bird	0 15 9
Esperanza	3 1 3
Tomboy	0 17 6
El Oro	1 3 9
Oroville	0 11 3

Cabled through Wm. P. Bonbright & Co., N. Y.

NEVADA STOCKS. Feb. 24.
Furnished by Weir Bros. & Co., New York.

Name of Comp.	Clg.
COMSTOCK STOCKS	
Belcher	.23
Best & Belcher	.33
Caledonia	.10
Challar	.09
Comstock	.28
Con. Cal. & Va	.41
Crown Point	.30
Exchequer	.25
Gould & Curry	.13
Hale & Norcross	.17
Mexican	.68
Ophir	1.25
Overman	.12
Potosi	.09
Savage	.17
Sierra Nevada	.25
Union	.25
Utah	.02
Yellow Jacket	.39
TONOPAH STOCKS	
Belmont	.83
Extension	.67
Golden Anchor	.01
Jim Butler	.15
MacNamara	.35
Midway	.20
Montana	.77
North Star	.02
Tono'h Mine of N.	6.00
West End Con	.33
GOLDFI'D STOCKS	
Adams	.02½
Atlanta	.13
Booth	.20
Columbia Mt.	.12
Comb. Frac	.99
Con. Red Top	.08
Cracker Jack	.04
Dia'dfield B. B. C.	.08
Goldfield Belmont	.04
Goldfield Daisy	.63
Great Bend	.18
Jumbo Extension	.15
Kendall	.05
Lone Star	.04
May Queen	.03
N. Y. C. O. D.	‡.04
Oro	.10
Red Hill	.09
Roanoke	...
Sandstorm	.12
Silver Pick	.08
St. Ives	.12
Triangle	.02
BULLFROG STOCKS	
Gibraltar	.04
Homestake King.	.04
Mont. Shoshone C.	1.87½
Tramp Cons	.09½
MISCELLANEOUS	
Bonnie Clare	.04
Lee Gold Grotto	...
Nevada Hills	1.37½
Nevada Smelting.	1.00
Nevada Wonder	.55
Nevada-Utah	2.75
Penn-Wyoming	.06
Pittsburgh S. Pk.	.70
Rawhide Coal	.44
Round Mt. Sphinx	.05

COLO. SPRINGS Feb. 19

Name of Comp.	Clg.
Acacia	6½
Black Bell	....
C. C. Con	3⅝
Dante	6⅛
Doctor Jack Pot	8⅞
Elkton	70¾
El Paso	49⅜
Findlay	17
Gold Dollar	13¾
Gold Sovereign	‡3⅛
Isabella	24
Index	....
Jennie Sample	8⅛
Jerry Johnson	‡6
Mary McKinney	35
Pharmacist	3½
Portland	1.00
Un. Gold Mines	4⅞
Vindicator	78
Work	7½

Assessments

Company.	Delinq.	Sale.	Amt.
Addie, Utah	Feb. 15	Mar. 6	$0.00½
Atlantic, Ida	Feb. 20	Mar. 22	0.00½
Belcher, Nev	Mar. 10	Mar. 31	0.10
Bullion, Nev	Feb. 24	Mar. 18	0.05
East Hercules, Wash	Feb. 15	Mar. 15	0.00½
Gould & Curry, Nev	Feb. 15	Mar. 9	0.10
Lady Washington, Nev	Feb. 19	Mar. 12	0.05
Little Chief, Utah	Feb. 23	Mar. 16	0.01
National, Mich	Mar. 15		0.40
Overman, Nev	Feb. 18	Mar. 11	0 00
Reindeer, Ida	Feb. 15	Mar. 15	0.10½
Seven Bros.-Pioche, Nev	Feb. 1	Feb. 27	0.00⅝
Sierra Nevada, Nev	Feb. 12	Mar. 5	0.10
Silver Eagle, Ida	Feb. 1	Mar. 1	0.001
Socrates, Cal	Feb. 15	Mar. 15	0.20
Spanish Ridge, Cal	Feb. 11	Apr. 10	0.03
Temple, Ida	Feb. 22	Mar. 15	0.005
Utah-United, Utah	Feb. 15	Mar. 1	0.01
Zeibright, Cal	Feb. 15	Mar. 6	0.05

Monthly Average Prices of Metals

SILVER

Month.	New York.		London.	
	1908.	1909.	1908.	1909.
January	55.678	51.750	25.738	23.834
February	56.000	.....	25.855	.....
March	55.365	.....	25.570	.....
April	54.505	.....	25.133	.....
May	52.795	.....	24.377	.....
June	53.663	.....	24.760	.....
July	53.115	.....	24.514	.....
August	51.683	.....	23.858	.....
September	51.720	.....	23.877	.....
October	51.431	.....	23.725	.....
November	49.647	.....	22.933	.....
December	48.769	.....	22.493	.....
Year	52.864	.....	24.402	.....

New York, cents per fine ounce; London, pence per standard ounce.

COPPER

	NEW YORK.				LONDON.	
	Electrolytic		Lake.			
	1908.	1909.	1908.	1909.	1908.	1909.
January	13.726	13.893	13.901	14.280	62.386	61.197
February	12.905	.....	13.098	.....	58.786	.....
March	12.704	.....	12.875	.....	58.761	.....
April	12.743	.....	12.928	.....	58.331	.....
May	12.598	.....	12.788	.....	57.387	.....
June	12.675	.....	12.877	.....	57.842	.....
July	12.702	.....	12.933	.....	57.969	.....
August	13.462	.....	13.639	.....	60.500	.....
September	13.388	.....	13.600	.....	60.338	.....
October	13.354	.....	13.646	.....	60.139	.....
November	14.130	.....	14.386	.....	63.417	.....
December	14.111	.....	14.411	.....	62.943	.....
Year	13.208	.....	13.424	.....	59.902	.....

New York, cents per pound. Electrolytic is for cakes, ingots or wirebars. London, pounds sterling, per long ton, standard copper.

TIN AT NEW YORK

Month.	1908.	1909.	Month.	1908.	1909.
January	27.380	28.060	July	29.207	.....
February	28.978	.....	August	29.942	.....
March	30.577	.....	September	28.815	.....
April	31.702	.....	October	29.444	.....
May	30.015	.....	November	30.348	.....
June	28.024	.....	December	29.154	.....
			Av. year	29.465	.....

Prices are in cents per pound.

LEAD

Month.	New York.		London.	
	1908.	1909.	1908.	1909.
January	3.691	4.175	14.469	13.113
February	3.725	.....	14.250	.....
March	3.838	.....	13.975	.....
April	3.993	.....	13.469	.....
May	4.253	.....	12.938	.....
June	4.466	.....	12.600	.....
July	4.447	.....	13.000	.....
August	4.580	.....	13.375	.....
September	4.515	.....	13.125	.....
October	4.351	.....	13.375	.....
November	4.330	.....	13.538	.....
December	4.213	.....	13.156	.....
Year	4.200	.....	13.439	.....

New York, cents per pound. London, pounds sterling per long ton.

SPELTER

Month.	New York.		St. Louis.		London.	
	1908.	1909.	1908.	1909.	1908.	1909.
January	4.513	5.141	4.363	4.991	20.563	21.425
February	4.788	.....	4.638	.....	20.875	.....
March	4.665	.....	4.527	.....	21.075	.....
April	4.645	.....	4.495	.....	21.344	.....
May	4.608	.....	4.458	.....	19.906	.....
June	4.543	.....	4.393	.....	19.000	.....
July	4.485	.....	4.338	.....	19.031	.....
August	4.702	.....	4.556	.....	19.350	.....
September	4.769	.....	4.619	.....	19.563	.....
October	4.801	.....	4.651	.....	19.750	.....
November	5.059	.....	4.909	.....	20.875	.....
December	5.137	.....	4.967	.....	20.625	.....
Year	4.726	.....	4.578	.....	20.163	.....

New York and St. Louis, cents per pound. London in pounds sterling per long ton.